Revision of North American *Tachysphex* Wasps Including Central American and Caribbean Species (Hymenoptera: Sphecidae)

By

Wojciech J. Pulawski

Published by
California Academy of Sciences

Natural History
Museum
& Aquarium

San Francisco
1988

Memoirs of the California Academy of Sciences Number 10

Cover Illustration: Head of *Tachysphex ashmeadii*, a female. Photo by W. Pulawski and M. A. Tenorio.

© 1988 by the California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118
ISBN 0-940228-16-5
Library of Congress Catalog Card Number 88-070114

CONTENTS

ABSTRACT 1
INTRODUCTION 1
General 1
Technical Terms and Symbols 1
Male Genitalia 1
Locality Records 2
Sources of Material 2
Collectors' Names 3
Acknowledgments 3
GENUS *TACHYSPHEX* KOHL 3
Morphology 3
Life History 4
Geographic Distribution of Species 6
Classification of the Genus 8
Unsolved Taxonomic Problems 9
KEYS TO THE SPECIES 9
DESCRIPTIONS OF THE SPECIES 20
pompiliformis Species Group 20
pompiliformis (Panzer, 1805) 20
montanus (Cresson, 1865) 25
aethiops (Cresson, 1865) 26
orestes sp. n. 31
angelicus sp. n. 33
acutus (Patton, 1880) 34
punctifrons W. Fox, 1891 37
powelli R. Bohart, 1962 38
semirufus (Cresson, 1865) 40
pauxillus W. Fox, 1894 42
eldoradensis Rohwer, 1917 46
hopi sp. n. 47
pechumani Krombein, 1938 50
bohartorum Pulawski, 1982 51
irregularis Pulawski, 1982 55
laevifrons (F. Smith, 1856) 56
tarsatus (Say, 1823) 57
williamsi R. Bohart, 1962 62
spatulifer Pulawski, 1982 63
crenulatus W. Fox, 1894 65
miwok sp. n. 67
krombeini Kurczewski, 1971 70
antennatus W. Fox, 1894 72
crassiformis Viereck, 1906 75
cubanus Pulawski, 1974 77
dominicanus sp. n. 79
paiute sp. n. 80
pinal sp. n. 81
toltec sp. n. 83
idiotrichus Pulawski, 1982 85
tahoe sp. n. 86
musciventris Pulawski, 1982 88
occidentalis Pulawski, 1982 91
solaris Pulawski, 1982 93
apricus Pulawski, 1982 94
sulcatus sp. n. 97
tipai sp. n. 99
mirandus Pulawski, 1982 102
verticalis Pulawski, 1982 104

opata sp. n. 106
hurdi R. Bohart, 1962 108
psammobius (Kohl, 1880) 109
glabrior Williams, 1914 112
oasicola sp. n. 113
amplus W. Fox, 1894 115
yolo Pulawski, 1982 117
yuma Pulawski, 1982 120
texanus (Cresson, 1872) 121
huchiti sp. n. 126
arizonac Pulawski, 1982 129
lamellatus Pulawski, 1982 130
tsil sp. n. 131
sonorensis (Cameron, 1889) 133
papago Pulawski, 1982 137
scopaeus sp. n. 137
psilocerus Kohl, 1880 139
ashmeadii W. Fox, 1894 141
terminatus Species Group 145
clarconis Viereck, 1906 147
antillarum Pulawski, 1974 149
ruficaudis (Taschenberg, 1870) 149
alpestris Rohwer, 1908 151
linsleyi R. Bohart, 1962 153
quisqueyus sp. n. 156
terminatus (F. Smith, 1856) 156
similis Rohwer, 1910 161
apicalis W. Fox, 1893 164
brullii Species Group 168
brullii Subgroup 168
mundus W. Fox, 1894 169
aequalis W. Fox, 1894 172
robustior Williams, 1914 176
maurus Rohwer, 1911 177
utina sp. n. 179
belfragei (Cresson, 1872) 180
krombeinellus Pulawski, 1982 181
menkei Pulawski, 1982 184
maya sp. n. 186
acanthophorus Pulawski, 1982 187
armatus Pulawski, 1982 191
cocopa sp. n. 191
obscuripennis Subgroup 192
inconspicuus (Kirby, 1890) 193
iridipennis (F. Smith, 1873) 196
alayoi Pulawski, 1974 198
julliani Species Group 200
coquilletti Rohwer, 1911 200
cockerellae Rohwer, 1914 204
LITERATURE CITED 207
INDEX OF SPECIES NAMES 210

ABSTRACT

North and Central American as well as Caribbean wasps of the genus *Tachysphex* are revised (totaling 83 species). Descriptions, illustrations, geographic records, distribution maps, and keys to the species identification are provided. The life histories are summarized and interpreted. A cladistic analysis is given for the *terminatus* species group. Twenty species are new: *angelicus* (western United States), *cocopa* (southwestern United States, western Mexico), *dominicanus* (Hispaniola), *hopi* (western United States), *huchiti* (western United States, Mexico), *muya* (Mexico, Costa Rica), *miwok* (California and adjacent areas), *oasicola* (western United States), *opata* (western United States, Mexico), *orestes* (western North America), *paiute* (California, Baja California), *pinal* (western United States, Mexico), *quisqueyus* (Hispaniola), *scopaeus* (Texas), *sulcatus* (California, Baja California), *tahoe* (western United States, Baja California), *tipai* (western United States, Mexico), *toltec* (Mexico), *tsil* (western United States, Mexico), and *utina* (southeastern United States). *Tachysphex aequalis* W. Fox and *robustior* Williams, previously sunk to subspecific status, are recognized as full species. The following are newly established synonyms: *pompiliformis* (Panzer, 1805) =*parvulus* (Cresson, 1865), *quebecensis* (Provancher, 1882), *decorus* W. Fox, 1894, *tenuipunctus* W. Fox, 1894, *erythraeus* Mickel, 1916, and *angularis* Mickel, 1916; *psammobius* (Kohl, 1880) = *sculptilis* W. Fox, 1894.

Received 27 December 1986. Accepted 13 January 1987.

INTRODUCTION

GENERAL.—This paper is a continuation of my worldwide studies of the genus *Tachysphex*. I previously revised the Palearctic species (Pulawski 1971), the Neotropical species (Pulawski 1974*a*), and the Australian species (Pulawski, 1977*a*). The North American species have not been systematically studied since W. Fox (1894*a*) and Williams (1914). As a result, many species (some of them common and widely distributed) were unnamed; numerous phena of unclear status needed to be recognized either as full species or individual variants; identification of most species was extremely difficult due to lack of reliable keys; and, in some cases, two or more names were simultaneously used for the same species. At present, 83 species have been defined, of which 20 are new. I was not able to define several phena that may represent a dozen or so species.

Since this study extended over a long period, preliminary diagnoses of 19 new species were published earlier (Pulawski 1982). Also, as a part of this project, I established several new synonyms (a few of them erroneously) in Krombein (1979). As a historical curiosity, the project started in Washington, D.C., while I was on a postdoctoral fellowship at the Smithsonian Institution (1974–75), was carried over in the Natural History Museum, Wroclaw University, Poland (1975–80), and completed at the California Academy of Sciences, San Francisco (1981–86).

Although this study is regional in scope, morphological characters and life histories are treated on a worldwide basis insofar as possible.

TECHNICAL TERMS AND SYMBOLS.—I follow Bohart and Menke (1976) in their usage of morphological terms, but a few terms and symbols need clarification or are redefined here for convenience. They are:

Axilla: topographically the anterolateral part of the scutellum (morphologically a part of the scutum).

Clypeus (Fig. 1): has a middle section and two lateral sections. The middle section usually has a densely punctate, setose basomedian area, a sparsely punctate, shining bevel, and a marginal lip. The prominent part of the middle section is often referred to as the lobe. The free margin of the lobe can be straight, concave, sinuate, arcuate, or biarcuate; the lip can have a mesal emargination, and/or one or two lateral incisions. The clypeal length is measured along the body's longitudinal axis.

Disk: the central part of a sclerite, e.g., scutal disk, tergal disk.

Frons: the area between the frontoclypeal suture and hindocellus.

Graduli: a pair of oblique furrows on sternum II and the following ones.

Hindcoxa carinate: with a carina on the inner dorsal margin.

Humeral plate of forewing: a sclerotized plate located basad to the costal and subcostal veins and partly covered by the tegula.

Mandibular acetabulum: mandibular articulation adjacent to the clypeus.

Mandibular condylus: mandibular articulation opposite the acetabulum.

Median plate of forewing: a small, elongate plate between the anal vein and the tegula.

Mesothoracic venter: the part of thorax between forecoxa and midcoxa.

Metapleural flange: a horizontal, lamellar expansion of the metapleural dorsal margin.

Micropunctures: punctures of very small size, significantly smaller than those on scutum.

MOD: midocellar diameter.

Postspiracular carina: a vertical or subvertical carina on the mesopleuron behind the pronotal lobe.

Scutum: abbreviation for mesoscutum.

Setae appressed, erect, inclined: forming an angle of approximately 0°, 90°, or an intermediate angle with the body surface, respectively.

Subcontiguous: nearly touching each other.

Tergum, sternum: abbreviations for gastral tergum, gastral sternum.

Vertex length (Fig. 2): the distance between a hindocellus and an imaginary line connecting the eye hindcorners (i.e., the point where the inner and the posterior portions of the orbit meet).

Vertex width (Fig. 2): the shortest interocular distance.

! followed by the word holotype, lectotype, or neotype in bibliographic citations: indicates that I have examined the specimen.

— after the state, province, or county name in Records sections: the county or specific locality unknown.

MALE GENITALIA.—Generally in *Tachysphex*, male genitalia and especially the shape of the volsella provide important recognition features. This is not the case among the North American species. Only a few have a distinctive volsella or penis valve (illustrations have been provided in these instances). In most species, including all of the *pompiliformis* group, the gen-

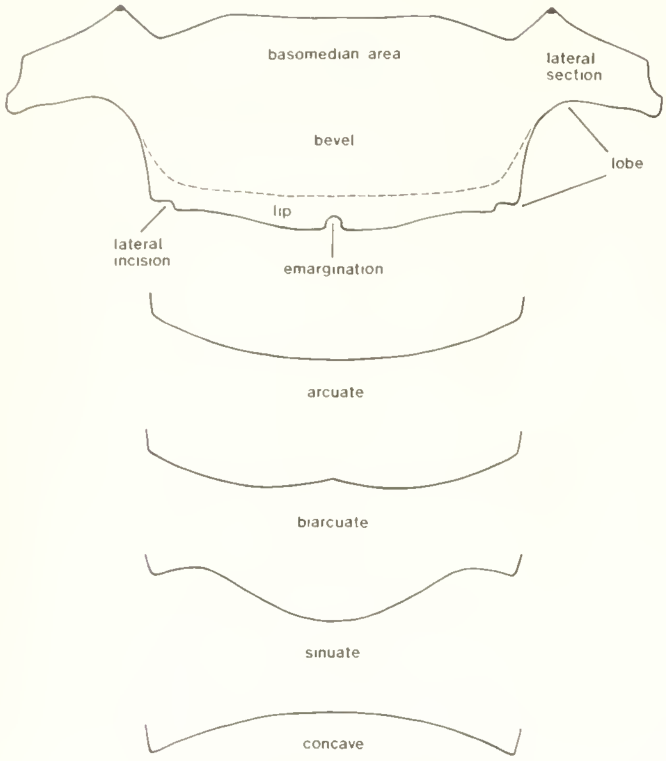

FIGURE 1. Clypeus of *Tachysphex*

ital organs are similar and individually variable, so that they are useless for diagnostic purposes. A striking example of individual variation is provided by *Tachysphex acanthophorus* in which the dorsal process of the volsella may be higher than wide or markedly lower than wide, with all possible intermediates.

LOCALITY RECORDS.—All place names listed under Records have been checked against available maps or gazetteers, and names not found there have been excluded. Also excluded are conflicting data (such as labels that place localities in the wrong county). After verification, the locality lists were used to produce the distribution maps. If a species has been found in more than three localities within a county, usually only the county name is listed. The same rule has been applied, in some cases, to the Mexican states of Baja California Norte and Baja California Sur.

Altitudes and distances are given as they appear on the original labels—mostly in feet and miles, because the metric system is not widely used in the United States, and distances and altitudes on most maps and atlases are given in English units.

SOURCES OF MATERIAL.—More than 40,100 specimens have been examined. I collected many in the United States, Mexico, and the Caribbean Islands during seven seasons (frequently helped by my wife Veronica E. Ahrens), but most were made available for study by institutions and individuals. In the Species Descriptions section, sources of material are indicated for all new species as well as for previously described rare species, but are omitted for common species. The following is a list of sources and persons who arranged the loans (the abbreviations preceding the names are used in the text to designate these collections):

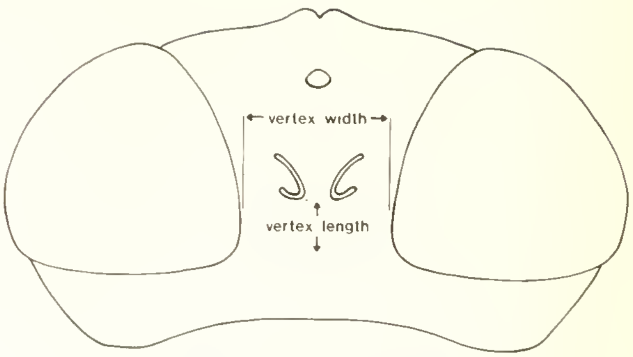

FIGURE 2. Vertex of *Tachysphex*

AMNH	American Museum of Natural History, New York, New York (M. S. Favreau)
ANSP:	Academy of Natural Sciences of Philadelphia, Philadelphia, Pennsylvania (D. C. F. Rentz)
ASU:	Arizona State University, Department of Zoology, Tempe, Arizona (F. F. Hasbrouck)
BISH.	Bernice P. Bishop, Museum, Honolulu, Hawaii (F. J. Radovsky).
BMNH	British Museum (Natural History), London, England (C. R. Vardy).
BU	Boston University, Department of Biology, Boston, Massachusetts (S. Duncan)
CAS	California Academy of Sciences, San Francisco, California (P. H. Arnaud, Jr., W. J. Pulawski, T. J. Zavortink).
CIS	California Insect Survey, Division of Entomology and Parasitology, University of California, Berkeley, California (J. A. Chemsak, H. V. Daly)
CNC	Canadian National Collections of Insects, Arachnids, and Nematodes, Biosystematics Research Institute, Ottawa, Ontario (J. R. Barron).
CPDA	Commonwealth of Pennsylvania Department of Agriculture, Bureau of Plant Industry, Harrisburg, Pennsylvania (F. E. Simons).
CSDA	California Department of Food and Agriculture, Sacramento, California (M. S. Wasbauer)
CSU	Colorado State University, Department of Zoology and Entomology, Fort Collins, Colorado (H. E. Evans).
CU	Cornell University, Department of Entomology and Limnology, Ithaca, New York (L. L. Pechuman)
FCDA	County of Fresno Department of Agriculture, Fresno, California (N. J. Smith)
FMNH	Field Museum of Natural History, Chicago, Illinois (R. L. Wenzel).
FSCA	Florida State Collection of Arthropods, Gainesville, Florida (E. E. Grissell, L. A. Stange, J. Wiley)
HKT	Henry K. Townes, American Entomological Institute, Ann Arbor, Michigan (now Gainesville, Florida)
HSU	Humboldt State University, Department of Biological Sciences, Arcata, California (D. M. Gordon)
IJ	Institute of Jamaica, Kingston, Jamaica (T. H. Farr).
INHS	Illinois State Natural History Survey, Urbana, Illinois (W. E. LaBerge).
ISU	Iowa State University, Department of Entomology, Ames, Iowa (the late J. L. Laffoon)
KSU	Kansas State University, Department of Entomology, Manhattan, Kansas (H. D. Blocker)
KU	University of Kansas, Snow Entomological Museum, Lawrence, Kansas (R. W. Brooks, G. W. Byers).
KVK	Karl V. Krombein, Arlington, Virginia (pers. coll.), now in USNM
KWC	Kenneth W. Cooper, Riverside, California (pers. coll.).
LACM	Natural History Museum of Los Angeles County, Los Angeles, California (R. R. Snelling)
LBSC	California State College at Long Beach, California (E. L. Sleeper).
LEM	MacDonald College of McGill University, Lyman Entomological Museum, Ste. Anne de la Bellevue, Quebec (A. T. Finnamore)
MCZ	Museum of Comparative Zoology at Harvard University, Cambridge, Massachusetts (J. F. Lawrence, J. C. Scott, M. K. Thayer)
MOB	Mark F. O'Brien, Ann Arbor, Michigan (pers. coll.)
MPM	Milwaukee Public Museum, Milwaukee, Wisconsin (J. K. Lawton).
MSU	Montana State University, Department of Zoology and Entomology, Bozeman, Montana (N. L. Anderson)

NCSU: North Carolina State University, Department of Entomology, Raleigh, North Carolina (C. S. Parron, D. A. Young).
NHMV: Naturhistorisches Museum, Vienna, Austria (M. Fischer).
NSDA: Nevada State Department of Agriculture, Reno, Nevada (R. C. Bechtel).
NYSU: New York State University, College of Environmental Science and Forestry, Department of Environmental and Forest Biology, Syracuse, New York (F. E. Kurczewski).
OSDA: State of Oregon Department of Agriculture, Salem, Oregon (R. L. Westcott).
OSU: Oregon State University, Department of Entomology, Corvallis, Oregon (G. R. Ferguson, P. W. Oman).
RBP: Robert B. Parks, ℅ San Diego Natural History Museum, San Diego, California (pers. coll.).
SDNH: San Diego Natural History Museum, San Diego, California (D. K. Faulkner).
TAI: Texas A&I University, Kingsville, Texas (J. E. Gillaspy).
TAM: Texas A&M University, Department of Entomology, College Station, Texas (H. R. Burke).
TLG: Terry L. Griswold, ℅ Bee Biology and Systematics Laboratory, Utah State University, Logan, Utah (pers. coll.).
UAE: University of Alberta, Department of Zoology, Edmonton, Alberta (A. L. Steiner).
UAF: University of Arkansas, Department of Entomology, Fayetteville, Arkansas (E. P. Rouse).
UAT: University of Arizona, Department of Entomology, Tucson, Arizona (C. A. Olson, F. G. Werner).
UCD: University of California, Department of Entomology, Bohart Museum, Davis, California (R. M. Bohart, R. O. Schuster).
UCR: University of California, Department of Biological Control, Riverside, California (S. I. Frommer).
UFG: University of Florida, Department of Entomology and Nematology, Gainesville, Florida (B. Saffer).
UGA: University of Georgia, Department of Entomology, Athens, Georgia (R. W. Matthews, C. L. Smith).
UIM: University of Idaho, Department of Entomology, Moscow, Idaho (W. F. Barr, J. B. Johnson).
UMA: University of Massachusetts, Department of Entomology and Plant Pathology, Amherst, Massachusetts (M. E. Smith).
UMMZ: University of Michigan, Museum of Zoology, Ann Arbor, Michigan (T. E. Moore, M. F. O'Brien).
UMSP: University of Minnesota, Department of Entomology and Zoology, St. Paul, Minnesota (P. J. Clausen).
UNL: University of Nebraska State Museum, Lincoln, Nebraska (B. C. Ratcliffe).
USNM: United States National Museum of Natural History (Smithsonian Institution), Washington, D.C. (K. V. Krombein, A. S. Menke).
USU: Utah State University, Department of Zoology, Logan, Utah (G. E. Bohart, F. D. Parker).
UW: University of Wisconsin, Department of Entomology, Madison, Wisconsin (L. J. Bayer).
WJP: Wojciech J. Pulawski, ℅ California Academy of Sciences, San Francisco, California (pers. coll.).
WSU: Washington State University, Department of Entomology, Pullman, Washington (the late M. T. James, R. S. Zack).
ZMB: Zoologisches Museum der Humboldt Universitat, Berlin, German Democratic Republic (the late E. Königsmann).

COLLECTORS' NAMES.—Collectors of specimens in type series of new species are abbreviated as follows (names mentioned once or a few times are not abbreviated):

ASM: Arnold S. Menke
DKF: David K. Faulkner
DSH: Donald S. Horning
EEG: E. Eric Grissell
EGL: E(arl) Gorton Linsley
EIS: Evert I. Schlinger
FDP: Frank D. Parker
FXW: Francis X. Williams
GEB: George E. Bohart
HEE: Howard E. Evans
HKC: Helen K. Court
JAP: Jerry A. Powell
JEG: James E. Gillaspy
JWB: John W. Brown
JWMS: John W. MacSwain
KWC: Kenneth W. Cooper
LAS: Lionel A. Stange
MEI: Michael E. Irwin
MSW: Marius S. Wasbauer
NJS: Norman J. Smith
PDH: Paul D. Hurd
PHA: Paul H. Arnaud, Jr.
PMM: Paul M. Marsh
RCB: Robert C. Bechtel
REC: Rollin E. Coville
TLG: Terry L. Griswold
TRH: Thomas R. Haig
WFB: William F. Barr
WJP: Wojciech J. Pulawski
WWM: Woodrow W. Middlekauff

ACKNOWLEDGMENTS.—The project was supported by a yearlong postdoctoral fellowship from the Smithsonian Institution in 1974–75, by grants from the Polish Academy of Sciences in 1976–80, five grants from the California Academy of Sciences In-House Research Fund in 1982–86, and the G. Lindsay Fund for Field Research. I sincerely thank all persons who sent me material for study and also other persons for their support and active help. Only some of them are listed here. Arnold S. Menke arranged most loans, significantly influenced the organization of this paper, read all descriptions (some of them many times), offered a cross-country collecting trip in 1975, and helped morally and materially in many other ways. Karl V. Krombein, equally friendly and helpful, took me on a collecting trip to Florida in April 1975 and commented on the manuscript. I owe thanks to Richard M. Bohart for two collecting trips to Borrego Valley, California (springs of 1975 and 1981), fruitful criticism, and friendly support. Baldomero Villegas took me to the Mt. Shasta area, California, in June 1981, and Dennis E. Breedlove to Baja California in March 1984 and to continental Mexico in September 1984. Robert E. Woodruff gave valuable assistance during my trip to the Dominican Republic, and Thomas H. Farr and Bryan E. Freeman helped organize fieldwork in Jamaica. Grażyna Zdunek typed countless early drafts of the text in Wrocław, Poland in 1975–80, drew the first version of distribution maps, and helped in many other ways. L. Gail Freihofer typed the manuscript on an NBI word processor in 1982. Mary Ann Tenorio produced the final version of the distribution maps and the scanning electron micrographs in 1983–86, and patiently helped with grammar, style, and editing. Thomas Duncan and David L. Wagner helped with cladistic analysis. Many persons helped in locating obscure locality names. My wife, Veronica E. Ahrens, willingly endured the hardships of many collecting trips and significantly contributed to the number of specimens and species collected. The nearly final version of the manuscript was reviewed, at my request, by Paul H. Arnaud, Jr., Helen K. Court, Frank E. Kurczewski, and Arnold S. Menke. Richard M. Bohart volunteered to review the introduction and the key, and Vincent F. Lee checked the manuscript for spelling and consistency. All suggested innumerable improvements.

GENUS *TACHYSPHEX* KOHL

Tachysphex Kohl, 1883:166. Type species: *Tachysphex filicornis* Kohl, 1883 (=*Tachytes fugax* Radoszkowski, 1877), designated by Bingham 1897:192.
Atelosphex Arnold, 1923:177. Type species: *Atelosphex miscophoides* Arnold, 1923 by original designation and monotypy. Synonymized with *Tachysphex* by Pulawski 1971:9.

MORPHOLOGY.—*Tachysphex* does not have a single autapotypic character state (=apotypic character state not found elsewhere), and thus it is not holophyletic according to the cladistic school. However, it certainly is not an artificial assemblage of unrelated species: any two species of *Tachysphex* are more similar to each other than to representatives of any other genus currently recognized, and it is more likely that their similarity is due to common origin rather than to convergence.

The modern morphological characterization of *Tachysphex* given by Bohart and Menke (1976) was refined by me (Pulawski 1979). All pertinent structural characters of the genus currently known are also reviewed below and compared with homologous features in *Holotachysphex* de Beaumont, *Parapiagetia* Kohl, and *Prosopigastra* A. Costa, the closest relatives of *Tachysphex*. These four genera form a single evolutionary branch within Larrini (Bohart and Menke 1976).

1) Frons with oblong, glabrous tubercle above each antennal socket; tubercles convergent above. These are also present in *Holotachysphex* and *Parapiagetia*, but absent in *Prosopigastra*.

2) Propodeal enclosure setose except glabrous in *sinaiticus* (Sinai Peninsula), many *tenuis* (Australia), and largely glabrous in many *walkeri* Turner. The enclosure is setose in *Holotachysphex*, setose or posteriorly glabrous in *Parapiagetia*, and glabrous in *Prosopigastra*.

3) Tergum I without short, oblique carina extending from each anterolateral corner. This carina is also absent in *Holotachysphex* and *Parapiagetia*, but present in *Prosopigastra*.

4) Tergum II not carinate laterally (most species). Menke (*in* Bohart and Menke 1976) stated that a sharp, lateral carina is only present on tergum I in *Tachysphex* and *Parapiagetia*, but that I and II are carinate laterally in *Holotachysphex* and *Prosopigastra*. Actually, a weak carina is also present on tergum II in some large Australian *Tachysphex*, especially females, e.g., *hypoleius*, *persistans*, *pugnator*, and *stimulator*. Also, the lateral carina of tergum II is rudimentary or absent in *Prosopigastra creon* and *nubigera* (Pulawski 1979).

5) The angle between the lateral margin of female tergum VI and the lateral margin of the pygidial plate, in side view, is about 30–40° in the apical third (tergum not flattened). This angle is similar in *Holotachysphex* and *Parapiagetia*, but much narrower (10–20°) in *Prosopigastra* (tergum flattened).

6) Female with pygidial plate except evanescent in the Old World *erythropus*, the South American *mendozanus*, and absent in the Australian *nefarius*. Present also in *Parapiagetia* and *Prosopigastra*, but absent in *Holotachysphex*.

7) Pygidial plate of female simple, except for a transverse, preapical row of punctures in the Old World species *costae* and *erythropus* and in the Australian *multifasciatus*. The pygidial plate is also simple in *Parapiagetia*, but in *Prosopigastra* it has a preapical, arcuate row of setigerous punctures that extends anterad along the marginal carina.

8) Sting circular in cross section. Similar in *Holotachysphex*, but flattened dorsoventrally in *Parapiagetia* and *Prosopigastra*.

9) Male tergum VII not depressed apically. Similar in *Holotachysphex* and *Parapiagetia*, but a translucent, impunctate apical depression is present in *Prosopigastra* (depression delimited by a row of punctures, which are evanescent in *P. ahrensiana* and *menelaus*).

10) Marginal cell of forewing not shortened, narrowly truncate apically: foremargin 2.7–4.2 × maximum width (inner dimensions), and the distance between posteroapical corner and the wing foremargin is 0.2–0.6 × maximum width. Marginal cell similar in *Holotachysphex* (same ratios: 2.7–3.5 and 0.5) and *Parapiagetia* except shorter in the *odontostoma* group (ratios: 1.1–3.6 and 0.3–0.9), shortened and more truncate apically in *Prosopigastra* (ratios: 1.6–2.3 and 0.6–0.9).

11) Forecoxal apex without apical process, except with an apical process in *Tachysphex bohartorum* and *hopi*. Process absent in *Holotachysphex* and *Parapiagetia*. A similar but nonhomologous process present in *Prosopigastra*.

12) Hindtarsomere II 0.5–0.7 × length of hindtarsomere I, 0.6–0.7 in *Holotachysphex* and most *Parapiagetia* (about 0.5 in *Parapiagetia mongolica*, but 0.3–0.4 in *Prosopigastra*).

13) No additional sclerites between the metasternal apex and propodeum. Similar in *Holotachysphex* and *Prosopigastra*, but a pair of sclerites ("propodeal sternum" of Menke *in* Bohart and Menke 1976) present in *Parapiagetia*.

14) Male forefemur notched in most species (entire in *Tachysphex antillarum*, *dominicanus*, *sericeus flavofimbriatus*, *maculipennis*, *quisqueyus*, *tenuis*, *vitiensis*, some *psilocerus*, and in the *geniculatus* species group). Forefemur notched in *Holotachysphex*, but entire in *Parapiagetia* and *Prosopigastra*.

15) Male sterna without velvety patches. Such patches are present in *Holotachysphex*, but absent in *Parapiagetia* and *Prosopigastra*.

16) Female foretarsus with a rake which consists of long, flexible setae. The rake is also present in *Parapiagetia* and *Prosopigastra*, but absent in *Holotachysphex*.

LIFE HISTORY.—In this section I review 27 behavioral components and discuss behavioral differences among species. Nearctic species are given special emphasis. Species from other zoogeographic regions are mentioned only when their behavior is known to differ. Detailed information on 25 Nearctic species is provided in this paper under Descriptions of the Species (where bibliographic references can be found). The life histories of 17 Palearctic species were summarized by Pulawski (1971). Later, I (Pulawski 1974*b*) observed the nesting habits of two additional species. Habits of Australian species have been elucidated mainly by Evans et al. (1976), but also by a few previous authors. Data for these seven species were summarized by Pulawski (1977*a*). Observations of three Neotropical species were summarized by Pulawski (1974*a*). Arnold (1945) briefly mentioned the prey of four Madagascan species, and Gess (1981) briefly described nesting habitats of seven South African species.

For each biological component, a list is given of Nearctic species in which this component has been documented.

1) *Generations*. Among North American species, there is one generation per year in *laevifrons*, *pompiliformis*, and *pechumani* (in which an obligate diapause is thus probable), two in *crassiformis*, two or more in *krombeini*, and two in *terminatus* (possibly up to five in southern Texas). The number of generations per year was not studied in non-Nearctic species.

2) *Food of adults*. Flower nectar is a common food, but honeydew is also important (*acutus*, *aequalis*, *alpestris*, *angelicus*, *antennatus*, *apicalis*, *apricus*, *ashmeadii*, *belfragei*, *coquilletti*, *hopi*, *krombeinellus*, *mundus*, *musciventris*, *opata*, *pauxillus*, *pompiliformis*, *punctifrons*, *similis*, *tahoe*, *tarsatus*, *terminatus*, *texanus*, *tipai*, *verticalis*, *yolo*).

3) *Relation of provisioning to nest digging*. Nest excavation by the female precedes hunting and oviposition (*aethiops*, *ashmeadii*, *clarconis*, *mundus*, *pechumani*, *semirufus*, *terminatus*).

4) *Nest site selection*. Nests are established in the soil (*aethiops*, *alpestris*, *apicalis*, *ashmeadii*, *belfragei*, *clarconis*, *coquilletti*, *crassiformis*, *inconspicuus*, *krombeini*, *laevifrons*, *mundus*, *pauxillus*, *pechumani*, *pompiliformis*, *psammobius*, *punctifrons*, *semirufus*, *similis*, *terminatus*, *texanus*).

5) *Nest placement*. Most species nidify on horizontal or inclined substrates but *apicalis* and also the Old World species

fugax and *costae* dig their nests exclusively in sloping banks of cliffs. Also, *terminatus* occasionally nidifies on sloping surfaces. Kurczewski and Snyder (1968) pointed out that nest placement in sloping banks implies: (1) the soil excavated from the nest rolls down and cannot be reused for nest closure (thus the nest is permanently open during the provisioning period), (2) soil from the sides and top of the burrow is used for the final closure, and (3) the female arriving at the nest with prey enters the burrow without pausing at the nest entrance.

6) *Use of preexisting nests.* Most species dig their own nests, but *mundus* and also two Old World species (*costae* and *plicosus*) use galleries of other aculeates. Burrows of other wasps are occasionally adapted for nests (*aethiops*). Females of *Prosopigastra* also establish their nests in burrows of other aculeates. Kurczewski (1979) demonstrated that *mundus* digs its nest in the wall of a preexisting gallery, a possibility that was not considered by authors observing the habits of *costae*, *plicosus*, and *Prosopigastra*. *Prosopigastra* and also *Tachysphex costae*, *mundus*, and *plicosus* have a long, dense foretarsal rake, contrasting with the shorter, sparser rake of the species that start their nest from the hard surface of the soil. This suggests a correlation between nesting behavior and structure of the foretarsal rake.

7) *Digging.* When starting a nest, the female first scratches the soil with her mandibles. She subsequently uses her forelegs in unison to rake away soil. The antennae are stretched out, and their apices touch the soil. From time to time she stops digging, walks away from the nest, and then walks towards the orifice while throwing the excavated soil with her hindlegs (*ashmeadii*, *pechumani*, *similis*). The material evacuated from the nest streams behind the wasp.

8) *Angle of nest burrow.* The burrow is never vertical. It forms an oblique angle with the surface in *aethiops*, *ashmeadii*, *krombeini*, *pechumani*, *pompiliformis*, *psammobius*, *punctifrons*, *semirufus*, *similis*, *tarsatus*, *terminatus*, and *texanus*. It is almost horizontal in *apicalis*, which nidifies on sloping banks or cliffs, and in *mundus*, which starts its own nests from preexisting burrows of other aculeates. In these species, material flows backwards in a constant stream during nest excavation. This would be impossible in vertical galleries. In fact, species that establish vertical nests either push the material backwards using abdomen (*Cerceris*) or hindlegs (*Astata*), or remove it with their mandibles (*Ammophila*).

9) *Tumulus.* In most species, the material excavated from the nest accumulates at the entrance as a tumulus (*aethiops*, *ashmeadii*, *krombeini*, *pauxillus*, *psammobius*, *punctifrons*, *pechumani*, *semirufus*, *tarsatus*). The tumulus is leveled in three species (all Nearctic): *clarconis*, *similis*, and *terminatus*, a habit apparently associated with temporary closure of the nest. The tumulus is slightly flattened in *pechumani* in which there is a rudimentary temporary closure of the nest.

10) *Orientation flight.* After completion of the nest, the female performs an orientation flight before leaving the nest area (*ashmeadii*, *clarconis*, *coquilletti*, *mundus*, *psammobius*, *tarsatus*). The female of *pechumani* performs orientation walks around the nest.

11) *Temporary closure.* During the provisioning period, the nest is permanently open in some species (*apicalis*, *ashmeadii*, *belfragei*, *crassiformis*, *krombeini*, *mundus*, *pauxillus*, *pompiliformis*, *psammobius*, *punctifrons*, *semirufus*, *tarsatus*, *texanus*). In others, it is closed except when the female is inside (*alpestris*, *clarconis*, *terminatus*, and also *pechumani*, in which the closure may be incomplete). Gess (1981) found that the nest entrances of two South African *Bembecinus* that nidify in sand (*braunsii* and *haemorrhoidalis*) are permanently open during the wasp's working day, but the nests of two other species that nidify in clay (*cinguliger* and *oxydorcus*) are closed except when the female is inside. It is not known whether this correlation is also valid for *Tachysphex*.

12) *Nest structure.* The nest consists of a gallery and one to six larval cells (*aethiops*, *alpestris*, *apicalis*, *ashmeadii*, *coquilletti*, *crassiformis*, *krombeini*, *pauxillus*, *pechumani*, *pompiliformis*, *psammobius*, *punctifrons*, *semirufus*, *similis*, *tarsatus*, *terminatus*, *texanus*). It is unicellular in several species.

13) *Prey.* Various orthopteroid insects are used as prey, namely: (1) Acrididae (*brevipennis*, *panzeri*, and *undatus* groups, most members of the *pompiliformis* group), (2) Tettigoniidae (some species of the *brullii* group; three species of the *pompiliformis* group: *semirufus*, *tipai*, and the Palearctic *fulvitarsis*; partly also *plicosus* of the *plicosus* group), (3) Gryllidae of the genus *Oecanthus* (main prey in the *plicosus* group, partly also *mundus* of the *brullii* group), (4) Blattidae (some species of the *brullii* group), and (5) Mantidae (*albocinctus*, *erythropus*, *julliani*, and *schmiedeknechti* groups). Elliott and Kurczewski (1985) listed a phasmid as prey of *apricus*, a record based on a paratype female pinned with *Parabacillus hesperus*. This association may be erroneous. Prey is unknown for the *euxinus*, *geniculatus*, *isis*, *mendozanus*, and *nefarius* groups, but their relationships suggest that members of the *euxinus* and *geniculatus* groups are acridid hunters, while those of the *isis* group are mantid collectors. Insects of one family are usually stored as prey, but representatives of two families have been found in four species: in *plicosus* (see Pulawski 1974*b*) and *mundus* (see Kurczewski 1979), in which tree crickets of the genus *Oecanthus* (Oecanthidae) were mixed with tettigoniids, in *terminatus* (see Kurczewski 1966*a*), which usually collects acridids but occasionally preys on tettigoniids, and in a nest of *krombeini* (see Kurczewski 1971) that contained six acridid nymphs and one tettigoniid nymph. In the last two species, the prey represent two different orthopteran suborders. Arnold (1945) mentioned that *micromegas*, a Madagascan species, collected "immature crickets and grasshoppers," but he gave no details, and his statement needs confirmation. Collecting members of two families may be normal because of their similar appearance.

14) *Stinging posture.* The female of *Tachysphex pechumani* pounces on a grasshopper, grasps it with her claws, orients her body transversely, bends the tip of her abdomen toward the ventral side of the grasshopper, and inserts the sting (Kurczewski and Elliott 1978). The grasshopper can prevent the wasp from stinging (Steiner 1982) by raising the hindlegs and freezing, or by biting (a female of *tarsatus* was severely bitten by a larva of *Trimerotropis pallidipennis* during a stinging attempt and died the following day), or by regurgitating fluids (a female of *tarsatus*, her gastral tip covered with sticky substance and sand grains, was found dying, presumably as the result of an unsuccessful attempt at paralyzing prey).

15) *Number of stings.* Steiner (1962) first established (in *Liris niger*) that during paralyzing the sting is inserted into the ventral side of the prey's body mainly in small membranous areas that he called stinging sites. Their number and location correspond to the number and location of the prey's main nerve ganglia. In

Tachysphex pompiliformis and *tarsatus*, stinging sites on grasshopper prey are (Steiner 1981): posteroadmedially on the head (for the subesophageal ganglion), admedially at the level of the forelegs (for the prothoracic ganglion), admedially between the fore- and midlegs and adjacent to the previous site (for the mesothoracic ganglion), and laterally between mid- and hindlegs (for the metathoracic ganglion). The number of stings may be equal to the number of stinging sites (also confirmed by Steiner's direct laboratory observations), or may be less (incomplete sequence), or rarely the stings or the stinging sequence may be repeated ("stinging frenzy"). In the past, various European authors, Sibuya (1933) and also Kurczewski and Elliott (1978; in *pechumani*), reported that the prey is paralyzed with one to three stings.

16) *Stinging sequence.* The stinging sequence is hindlegs, forelegs, midlegs, and mouthparts in the grasshopper collectors *pompiliformis* (as "unidentified species") and *tarsatus* (see Steiner 1981). This sequence contrasts with habits of *Prionyx parkeri*, another grasshopper collector, which first paralyzes the mouthparts and then the forelegs, midlegs, and hindlegs (Steiner 1981). *Tachysphex costae*, which preys on mantids, first paralyzes the raptorial forelegs (summary in Pulawski 1971; also Steiner 1981: 329).

17) *Cephalic mastication.* Mastication of prey's head to obtain fluids has been reported for *ashmeadii* and also for two Old World species (*albocinctus* and *brullii*). Mastication of the prey "near the area of the sting puncture" by a female of *psammobius* was reported by Kurczewski (1987).

18) *Type of prey transportation.* When carrying the prey, the female holds it by the antennal base with her mandibles and moves headfirst in *ashmeadii, belfragei, clarconis, crassiformis, krombeini, mundus, pauxillus, pechumani, pompiliformis, semirufus, similis, tarsatus*, and *terminatus*. This is the Mandibular Type Two of Evans (1962).

19) *Prey position during transportation.* Most authors report that the prey is carried venter down, including in *mundus*, but Kurczewski (1971) reports that the prey is transported venter up in *krombeini*. *Tachysphex terminatus* carries the prey venter up according to Kurczewski (1966*a*) and venter down according to Strandtmann (1953). William's (1914) description suggests that prey of *ashmeadii* and *tarsatus* are kept venter up. Perhaps the prey is carried in the position in which it is paralyzed.

20) *Aerial and terrestrial prey transportation.* The prey is carried on the ground, or in a series of short flights, or in one continuous flight (*alpestris, ashmeadii, belfragei, clarconis, crassiformis, krombeini, mundus, pauxillus, pechumani, pompiliformis, psammobius, punctifrons, similis, tarsatus, terminatus, texanus*). In *pechumani*, the prey is flown if its weight does not exceed twice the female's weight; heavier prey (up to six times the female's weight) is transported on the ground.

21) *Entering nest with prey.* In most species, the female deposits the prey at the nest entrance, opens it (if the nest is temporarily closed), and then enters. She turns around inside, pokes her head out of the nest entrance, grabs the prey with her mandibles, and pulls it inside (*clarconis, krombeini, pechumani, pompiliformis, similis, terminatus*). Females of *ashmeadii* and *mundus* (that fly with prey) enter the nest directly, and so does the female of *punctifrons* (that walks with prey). Females of *crassiformis, psammobius, tarsatus*, and *texanus* either drop the prey or enter the nest directly. Females of two Old World species, *mediterraneus* and *albocinctus*, open the nest without dropping the prey (this method apparently protects the nest and the prey better from dipterous parasites).

22) *Cell provisioning.* Cell provisioning is of the facultative multiple type, i.e., there is a single large prey or up to 10 small prey, their number inversely proportional to their size (*alpestris, apicalis, ashmeadii, belfragei, clarconis, crassiformis, krombeini, mundus, pauxillus, pechumani, pompiliformis, punctifrons, similis, tarsatus, terminatus, texanus*). Only one prey per cell was found in 28 fully provisioned cells of *pechumani* and in most cells of *ashmeadii*.

23) *Orientation of prey in cell.* Most prey are deposited venter up in the cell, but orientation varies in *japonicus*, an Oriental acridid hunter. Mantid prey of the Old World species *albocinctus* and *costae* may be deposited on their back, venter, or side. Prey position varies in the Nearctic species *ashmeadii* (prey mainly venter up, but sometimes on side), *krombeini* (mainly venter up, but sometimes dorsum up), *pechumani* (venter up), *mundus* (dorsum up or venter up), and *terminatus* (mainly dorsum up).

24) *Position of egg on prey.* The egg is mainly deposited across the body just behind a forecoxa (*apicalis, belfragei, clarconis, crassiformis, krombeini, mundus, pauxillus, pechumani, psammobius, punctifrons, texanus*), but in the Old World mantid collectors it is placed on the outer margin of forecoxa (*costae*) or in front of the forecoxae (*albocinctus*). The position of the egg was not examined in the New World mantid collectors.

25) *Time of ovipositing.* In some species, oviposition takes place after the provisioning is completed, and in others after the first prey item is stored. Most authors dealing with North American species reported the size of the prey selected for oviposition, but not the time: the egg is deposited on a medium-size prey in *apicalis*, the largest or the second largest in *mundus*, the largest in *punctifrons* and *similis*, the largest in most *terminatus*, and the second largest in *psammobius* and *texanus*. It is known, however, that in a nest of *ashmeadii* the egg was laid on the last item put in the nest.

26) *Male burrows.* Males spend the night and inclement weather in burrows dug for that purpose (*similis, tarsatus, terminatus*) or probably (*apicalis*) use preexisting holes. The tumulus is not leveled. When resting inside, they stay close to the bottom and face the entrance. The burrow is closed off from inside (*similis, tarsatus, terminatus*). Male burrows were not studied in non-Nearctic species.

27) *Male perching behavior.* Male perching behavior was studied only in five species, all North American. Fights between males were frequent in *apicalis, similis*, and *terminatus*, rare in *tarsatus*, and they were not seen in *laevifrons*.

As can be seen, *Tachysphex* basically are ground nesters that dig their own nests (a few use galleries of other insects) and prey upon various orthopterans; the nest galleries do not branch. Their close relatives have basically the same habits, with a few striking modifications. *Holotachysphex* nest in plant stems and prey upon pyrgomorphid Acridoidea, a type of prey not observed in *Tachysphex* (Gess 1978, 1981). *Prosopigastra* use preexisting cavities and prey upon Heteroptera (summary in Pulawski 1979). Little is known about *Parapiagetia* (see Pulawski 1977*b*): one record of *mongolica* with a caterpillar prey, and one record of *longicornis* with an acridid. Nest gallery may branch in *Kohliella* (Gess 1980).

Geographic Distribution of Species.—The highest concentration of species is found in the southwestern United States (Fig. 3). The number of species in eastern North America is

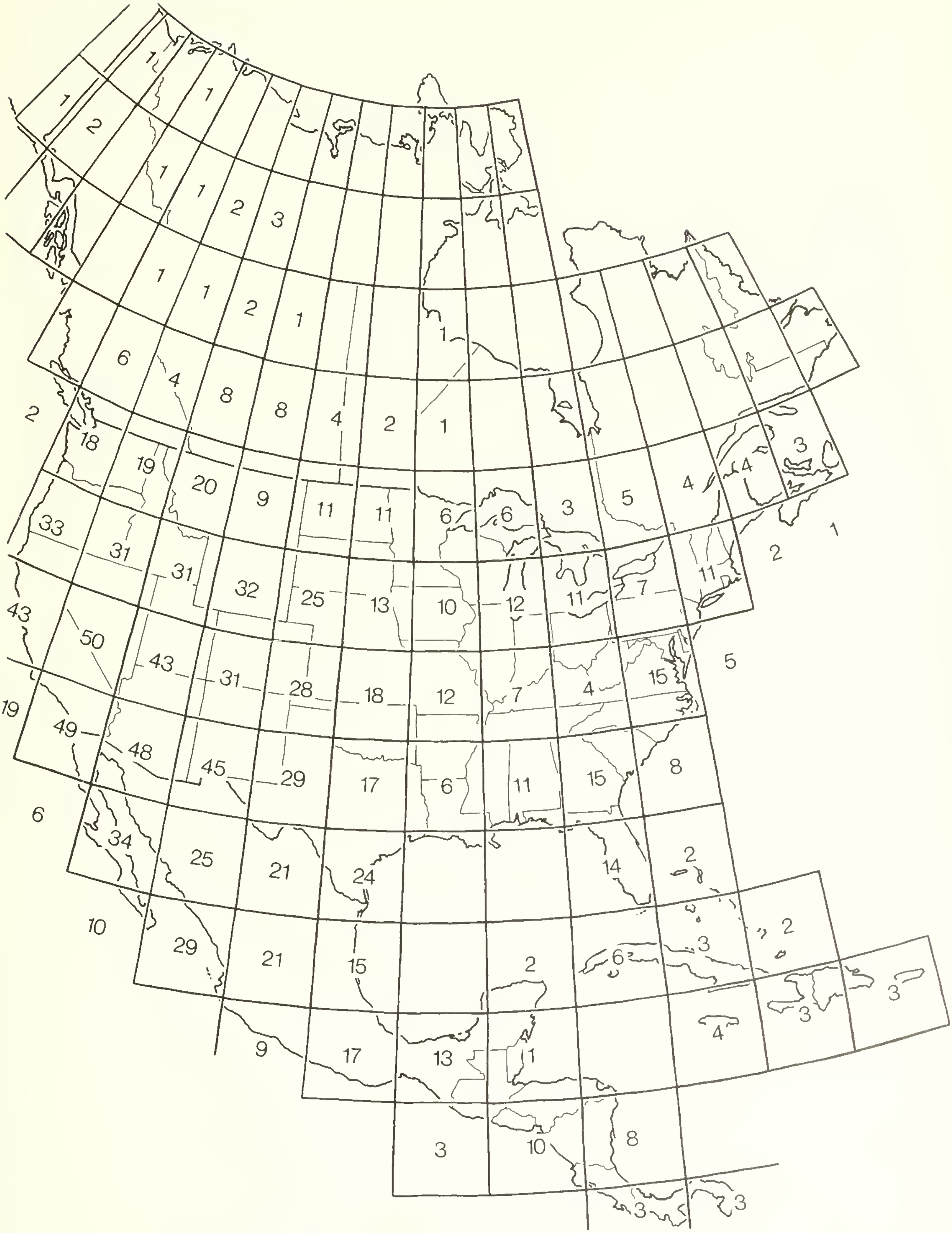

FIGURE 3. Number of species of *Tachysphex* in squares of 5 degrees of longitude and of latitude.

much lower, although the area is equally well collected. I conclude that these numbers are proportional to the diversity of habitats (which is significantly greater in the western United States than in the eastern), and suggest that speciation in *Tachysphex* depends upon this diversity. The fact that more species of *Tachysphex* occur in the southwestern than the northwestern United States indicates that habitats with high temperatures and low humidity are best suited for most members of the genus.

The ranges of individual species differ longitudinally, latitudinally, and altitudinally, and apparently depend on ecological, historical, and populational factors. Some examples are discussed below.

1) Most North American species are endemic, but two (*pompiliformis* and *psammobius*) also occur in the Palearctic Region, and two species widely distributed in South America range into the southern United States (*iridipennis, ruficaudis*), and one (*inconspicuus*) to northern Mexico.

2) Relatively few species extend from Atlantic to Pacific coasts: *antennatus, apicalis, crassiformis, pompiliformis, semirufus* (only at the latitude of the Great Lakes), *tarsatus,* and *texanus.* The range of *aethiops* is similar, but the species has not been found between the Great Lakes and the Atlantic Coast. Most species are restricted to eastern (10 species) or to western North America (41 species). Remarkably, the western limits of the eastern species and the eastern limits of the western species do not coincide with any physical barriers (such as the Rocky Mountains). These limits must therefore depend upon some ecological factor, most likely humidity. Indeed, the relative humidity is markedly higher in the east than it is in the west (less than 20% in some areas in July), with the 60% line, for the April–July period, being close to the 100th meridian. The transcontinental species apparently tolerate various humidity levels.

3) *Tachysphex aethiops, pompiliformis,* and *semirufus* extend much farther south in the west (where they only occur in the mountains) than they do in the east (where they are found in lowlands). Apparently they are less tolerant of high temperatures than the other species.

4) *Tachysphex alpestris* has a more extensive north–south distribution than any other species (Alaska to Costa Rica). It occurs in a variety of habitats, from coastal beaches to high mountains. I interpret such a wide distribution as indication of wide tolerance of high and low temperatures and of high and low humidity. Another possibility, however, is that the microhabitats occupied by *alpestris* are all ecologically similar during its flight period.

5) Several pairs of closely related species have mutually exclusive ranges and different preferences for temperature and or humidity (examples: *aequalis* and *mundus, alpestris* and *terminatus, antennatus* and *krombeini, laevifrons* and *tarsatus*). Most probably each pair had a common ancestor with a continuous geographic range. Subsequently the ranges became divided into an eastern and a western part (or southeastern and western), possibly during the Pleistocene; each population gradually differentiated morphologically and ecologically, and finally became isolated genetically. The western and southeastern forms of *apicalis* seem to be at an intermediate stage of such an isolation process. It is also possible that each member of a pair fills an ecological niche and makes it unavailable for the other.

6) The disjunct distribution of *pechumani,* which occurs only in southern New Jersey and the Lower Peninsula of Michigan, can be best explained by splitting of an initially continuous range during the Pleistocene glaciations, and the presence of some ecological barriers (perhaps absence of sandy soils) between the two parts of the extant range.

7) A type of distribution difficult to interpret is represented by *glabrior* which occurs from Central America to the Great Plains.

8) Three of the eight Caribbean species range widely on the adjacent continents, but have limited distributions on the islands (*apicalis* is known from two localities in eastern Cuba), *inconspicuus* from two localities in Jamaica, and *ruficaudis* from one locality in Jamaica). They probably are recent migrants to the area. Their migrations may have taken place during the Pleistocene, when the sea level dropped 130 m and greatly reduced the water barrier between Cuba and Florida on one side, and Jamaica and Central America on the other side. The remaining five species (*alayoi, antillarum, cubanus, dominicanus, quisqueyus*) probably evolved from ancestors that colonized the Caribbeans at an earlier time.

CLASSIFICATION OF THE GENUS.—The present supraspecific classification was achieved by traditional taxonomic methods (study of characters, comparison of species, mental recognition of groups with unique characters or a unique combination of characters). This classification has several drawbacks, the most obvious being the heterogeneous nature of the *pompiliformis* group (which simply includes species lacking the diagnostic features of other groups and is not based on any synapomorphy). Clearly a worldwide cladistic analysis at the species group level in *Tachysphex* is imperative, but such an endeavor is beyond the scope of this regional revision, and will be attempted in a separate study. Therefore the traditional groups are used here.

De Beaumont was the first to subdivide *Tachysphex.* He used species groups rather than subgenera, recognizing seven such groups among the French species (1936), seven more (1940) in his revision of the Egyptian species (one subsequently became the genus *Holotachysphex*), and two additional groups in his other papers (1947*a, b*). The groups were based on characters such as the shape and length of the labrum and mouthparts, proportions of the vertex, shape of the gena (thick or thin) as seen from above, sculpture of the thorax, presence or absence of an episternal sulcus, shape of the propodeum, presence or absence of a median carina on sternum I, whether or not the hindtibial spur was modified, shape and sculpture of the female pygidial plate, presence or absence of a forefemoral notch in the male, and the type of sternal pilosity in the male. I found some of these characters unreliable at the species group level. I redefined (Pulawski 1971) all of de Beaumont's groups by adding some newly discovered characters (such as shape of the foretarsi, size of the jugal lobe, orientation of the veinlet cu-a in the hindwing), as well as using biological features (prey type). I combined some groups (e.g., *brullii, graecus,* and *obscuripennis* groups) and established one new group (the *euxinus* group). Subsequently, I also established three more groups (*mendozanus, terminatus, undatus*) in the South American fauna (Pulawski 1974*a*) and another (*nepharius*) in Australia (1977*a*). Menke (*in* Bohart and Menke 1976) in his review of *Tachysphex* kept the *brullii* and the *obscuripennis* groups separate based on prey.

I currently recognize the following 16 species groups:

albocinctus group of de Beaumont 1940 (xeric areas of world except North America), *brevipennis* group of de Beaumont 1940 (South Africa to Mediterranean Basin, India, and Transcaspia), originally named the *imperfectus* group and renamed by Pulawski 1971.

brullii group of de Beaumont 1936 (cosmopolitan), originally named the *spoliatus* group (*spoliatus* is a junior synonym of *brullii*); includes the *obscuripennis* group of de Beaumont 1936 (originally named the *lativalvis* group but *lativalvis* is a junior synonym of *obscuripennis*) and the *graecus* group of de Beaumont 1947*b*).

erythropus group of de Beaumont 1936 (South Africa to Mediterranean Basin, India, and Transcaspia), originally named the *fluctuatus* group and renamed by Pulawski 1971.

euxinus group of Pulawski 1971 (Bulgaria to Lebanon, one species).

geniculatus group of de Beaumont 1940 (North Africa, Middle East), originally named the *luxuriosus* group and renamed by Pulawski 1971.

isis group of de Beaumont 1947*a* (Libya to Syria, one species).

julliani group of de Beaumont 1936 (South Africa to Mediterranean Basin, India, and Mongolia, New World).

mendozanus group of Pulawski 1974*a* (Argentina, one species).

nepharius group of Pulawski 1977*a* (Australia, one species).

panzeri group of de Beaumont 1936 (South Africa to central Europe, eastwards to India and Sri Lanka, China, and Mongolia).

plicosus group of de Beaumont 1936 (Africa to Mediterranean Basin, India, and Mongolia, two species), originally named *mediterraneus* group but renamed by Pulawski 1971.

pompiliformis group of de Beaumont 1936 (cosmopolitan), originally called the *pectinipes* group (*pectinipes* was a misdetermination of *pompiliformis*); includes the *nitidus* group of de Beaumont 1940 and the *speciosissimus* group of de Beaumont 1940.

schmiedeknechtii group of de Beaumont 1940 (North Africa to Soviet Middle Asia, one species).

terminatus group of Pulawski 1974*a* (New World).

undatus group of Pulawski 1974*a* (South America).

Neither Afrotropical nor Oriental *Tachysphex* have been recently revised. Judging from my preliminary studies, all of the Oriental species belong to established species groups, whereas some Afrotropical species do not belong to any of them, and new groups will have to be recognized to accommodate them. Only four groups are represented in North and Central America (*pompiliformis, terminatus, brullii*, and *julliani* groups) and none is endemic.

Unsolved Taxonomic Problems.—According to de Beaumont (1960:14), "the genus *Tachysphex* seems to have been created in order to discourage taxonomists." Indeed, it is more difficult taxonomically than most sphecid genera because of individual and geographic variation, frequent absence of striking morphological differences between species, and large number of species. More specifically, I have been unable to understand or to place numerous North American specimens, in spite of strenuous efforts extending over a decade. A similar situation was reported by de Beaumont (1947*a*) in his study of Egyptian species. A source of frustration for the reviser, the leftover individuals probably fall into three main categories: (1) strongly aberrant individual variants, (2) cryptic species that lack easily observed diagnostic structures, and (3) single representatives of undescribed species with conspicuous diagnostic characters. Individuals that seemingly belong to the second category are common in certain areas, e.g., Sierra Nevada, California. With few exceptions, the undefined specimens are not described or discussed in the text below, and this makes the identification keys somewhat unreliable. Therefore, in order to assure maximum accuracy and to avoid confusion with leftover forms, each identification should be carefully checked against the description of the species.

Keys to the Species

The characters used in the keys require fresh material with well-preserved pilosity. Many specimens with worn setae, or a worn clypeus, cannot be determined to species.

♀♀[1]

1. Pygidial plate narrower; apical segments of gaster with thin preapical setae 2
– Pygidial plate unusually broad (Fig. 147e); apical segments of gaster (Fig. 147c, d) with thick preapical setae (*julliani* group) 4
2. Apicoventral margin of tarsomere V straight; claws not prehensile 3
– Apicoventral margin of tarsomere V produced into lobe (Fig. 121d, 142e); claws prehensile (*brullii* group) 5
3. Vertex with callosity (Fig. 114a) behind each hindocellus (*terminatus* group) 20
– Vertex without callosities (*pompiliformis* group) 28

julliani species group

4. Clypeal bevel roundly swollen throughout, not overhanging base of lip (Fig. 147a, b); vertex setae appressed or nearly so; propodeal side at most finely ridged *coquilletti* Rohwer, p. 200
– Clypeal bevel ridgelike, overhanging base of lip (Fig. 150a, b); vertex setae erect; propodeal side distinctly ridged *cockerellae* Rohwer, p. 204

brullii species group

5. Mid- and hindtarsomere IV shorter than wide, obtusely emarginate apically (Fig. 142d, 144c, 146b); claws short, stout; foretibial outer face with setae, without spines 6
– Tarsomere IV as long as wide or longer (Fig. 121a), acutely emarginate (apex of emargination may be rounded); claws long, slender; foretibial outer face with setae and spines 8
6. Mid- and hindtarsomere IV (Fig. 142a–d): apical emargination weakly obtuse, with exposed membrane, apicoventral margin not produced into lobe; hindfemur slender (Fig. 141d); rake spines of forebasitarsus 2–3 × as long as basitarsal width; clypeal lip well defined (Fig. 141a), in vast majority of specimens with two lateral incisions on each side; vertex setae in most specimens 1.0–1.5 MOD long *inconspicuus* (Kirby), p. 193
– Mid- and hindtarsomeres IV (Fig. 144c, 146b, c): apical emargination markedly obtuse, with membrane hidden,

---

[1] See page 14

apicoventral margin produced into lobe; hindfemur shorter, stouter (Fig. 144b); rake spines of forebasitarsus at most twice as long as width of basitarsus; clypeal lip ill defined, without lateral incisions (Fig. 144a, 146a); vertex setae slightly less to slightly more than 2.0 MOD long 7

7. Setae of propodeal dorsum inclined posterad; gaster black; hindcoxa without basal tooth; tergum V in most specimens densely punctate before apical depression; pygidial plate in many specimens densely setose apically; southern Texas to Tropic of Capricorn *iridipennis* (F. Smith), p. 196

– Setae of propodeal dorsum inclined anterad basomedially; gastral apex red; hindcoxa with basal tooth (see Fig. 141c); tergum V sparsely punctate before apical depression; pygidial plate sparsely setose; West Indies, Florida *alayoi* Pulawski, p. 198

8. Erect body setae woolly (Fig. 133b); setae 2.5–3.0 MOD long on lower gena, 2.0–2.5 MOD anterolaterally on scutum; scutal punctures many diameters apart; terga II–V (except laterally) without micropunctures *menkei* Pulawski, p. 184

– Erect body setae straight; setae 0.8–1.3 MOD long on lower gena, very short, appressed on scutum; midscutal punctures less than one diameter apart in most specimens (two to three diameters apart in *maurus* and some *aequalis*); terga densely micropunctate 9

9. Midscutal setae oriented laterad (except on midline); tarsomere V with one or two small spines on lateral margin, in most specimens also with central cluster of small spines on venter (Fig. 136b, c, 138) 10

– Scutal setae oriented posterad; tarsomere V without spines on lateral margin (spines present in most *aequalis*) or on venter 11

10. Pygidial plate densely setose throughout (Fig. 140) *cocopa* sp. n., p. 191

– Pygidial plate sparsely setose 11

11. Tarsomere V without basoventral spines (Fig. 136b) *acanthophorus* Pulawski, p. 187

– Tarsomere V with basoventral spines (Fig. 138) *armatus* Pulawski, p. 191

12. Propodeal dorsum: anterad-oriented setae covering a median area that extends from base to apex, thus posterad-oriented setae broadly separated; mesopleural punctures large *maya* sp. n., p. 186

– Propodeal dorsum: anterad-oriented setae absent or present basomedially, posterad-oriented setae meeting apicomesally; mesopleural punctures fine to absent 13

13. Propodeal dorsum coarsely, irregularly rugose (Fig. 128b); side irregularly ridged *belfragei* (Cresson), p. 181

– Propodeal dorsum evenly microareolate (Fig. 120d, e); side at most finely ridged posteriorly 14

14. Clypeal lip broadened mesally (see Fig. 128a); mid- and hindfemora red (at least on apical third); central and southeastern United States *krombeinellus* Pulawski, p. 181

– Clypeal lip not broadened (Fig. 120a); femora in most specimens black 15

15. Gaster black 16

– Gaster red, at least basally 18

16. Scutum shiny, punctures averaging more than one diameter apart; mesopleural punctures well defined, one to two diameters apart at middle; propodeal side in most specimens punctate; Arizona to Oklahoma, south to Costa Rica *maurus* Rohwer, p. 177

– Scutum dull, its punctures one diameter apart or less; mesopleural punctures inconspicuous, in most specimens less than one diameter apart, interspaces dull; propodeal side impunctate 17

17. Scutal hindcorner rounded (Fig. 120c); axilla evenly convex; east of Rocky Mountains *mundus* W. Fox (typical form), p. 169

– Scutal hindcorner prominent (see Fig. 125a); axilla steplike; New Jersey to Florida *utina* sp. n., p. 179

18. Mesopleural punctures at middle two to five diameters apart (Fig. 123a, b); posterolateral corner of scutum rounded (see Fig. 120c); west of Rocky Mountains to Mexico, eastern Wyoming *aequalis* W. Fox, p. 172

– Mesopleural punctures at middle one diameter apart or slightly more, except in some *robustior* in which posterolateral corner of scutum is somewhat prominent (Fig. 125a); central Canada to Mexico 19

19. Scutum slightly prominent posterolaterally (Fig. 125a); gaster red, or red basally and black apically; Kansas to Mexico *robustior* Williams, p. 176

– Scutum rounded posterolaterally (Fig. 120c); gaster black apically; central Canada and United States *mundus* W. Fox (central United States and Canada form), p. 169

terminatus species group

20. Clypeal width 2.2 × length (Fig. 118a, b); lip mesally with small, obtuse projection; frons shiny, with well-defined punctures (Fig. 118c) except in occasional western specimens *apicalis* W. Fox, p. 164

– Clypeus wider, except in *similis* in which clypeal lip has no mesal projection and frons is dull, evenly microsculptured to indistinctly punctate (Fig. 116a) 21

21. Mesopleural punctures several diameters apart; upper metapleuron with longitudinal carina (in some specimens with few longitudinal ridges) that starts beneath anterior end of flange and ends before propodeal spiracle (Fig. 109b); metapleural flange broad; Arizona and southern California to Argentina *ruficaudis* (Taschenberg), p. 149

– Mesopleural punctures less than to slightly more than one diameter apart (averaging up to two diameters apart in Bahamian specimens of *similis*); upper metapleuron different (see couplets 22–24 below), its flange narrow (*clarconis*) or broad 22

22. Upper metapleuron with few simple ridges before propodeal spiracle; metapleural flange narrow, oblique carina beneath its anterior end vestigial or absent; gaster of many specimens all red; western North America *clarconis* Viereck, p. 147

– Upper metapleuron with prominence, lamella, or at least low carina (which is angulate posteriorly except in Caribbean species *antillarum*) before propodeal spiracle; metapleural flange broad, with oblique carina beneath its anterior end; gaster largely black (but all red in certain populations of *alpestris* and *linsleyi*) 23

23. Upper metapleuron with low carina (that is not angulate posteriorly) before propodeal spiracle; Caribbean Islands *antillarum* Pulawski, p. 149

– Upper metapleuron with prominence, lamella, or low carina that is angulate posteriorly; continental America and Bahamas 24

24. Prespiracular prominence of upper metapleuron rounded apically on admedian side, obtusely angulate apically, funnel-shaped in most specimens (Fig. 112a–c); oblique carina beneath anterior end of metapleural flange expanding, in many specimens, to outer edge of flange *linsleyi* R. Bohart, p. 153

– Prespiracular carina or prominence of upper metapleuron acutely angulate apically; oblique carina beneath anterior end of metapleural flange not expanding to outer margin of flange 25

25. Prespiracular prominence of upper metapleuron low, obtusely angulate in lateral view, its anterior margin markedly longer than the posterior margin (Fig. 111b–d) *alpestris* Rohwer, p. 151

– Prespiracular prominence of upper metapleuron large, toothlike, its anterior and posterior margins about equal in length (Fig. 114b–d, 116b–d) 26

26. Clypeal integument hidden by vestiture (except anteriorly); frons in most specimens with well-defined punctures; vertex width 2.0–2.2× length; anterolateral scutal setae about 2.0 MOD long; prespiracular prominence of upper metapleuron broad (Fig. 114b–d) *terminatus* (F. Smith), p. 156

– Clypeal integument not hidden by vestiture; frontal punctures conspicuous (*quisqueyus*) or ill defined (*similis*); vertex width : length ratio 1.4–1.7 in *similis*, 1.6–2.0 in *quisqueyus*; prespiracular prominence of upper metapleuron narrow (Fig. 116b–d) in some specimens; anterolateral scutal setae 1.0–1.3 MOD long 27

27. Frons with well-defined punctures; prespiracular prominence of upper metapleuron broad (see Fig. 114b–d); Hispaniola *quisqueyus* sp. n., p. 156

– Frons with ill-defined punctures; prespiracular prominence of upper metapleuron narrow in many specimens (Fig. 116b–d); continental North America and Bahamas *similis* Rohwer, p. 161

***pompiliformis* species group**

28. Subalar fossa carinate below; upper mesopleuron longitudinally ridged; postspiracular carina unusually long (Fig. 16a, b) *punctifrons* W. Fox, p. 37

– Subalar fossa not carinate below; mesopleuron not ridged; postspiracular carina shorter (except in *acutus*) 29

29. Midscutal setae oriented radially, forming a rosettelike pattern (Fig. 105d, e); axilla of usual shape; labrum convex and protruding beyond clypeus (Fig. 105b, c) in nearly all specimens; sternum I without apical depression; basal platform of sternum II acutely angulate *ashmeadii* W. Fox, p. 141

– Midscutal setae oriented longitudinally to transversely, but not radially; if radially then with following characters: basal plate of sternum II at least weakly biemarginate (*opata*), or clypeal lobe unusually broad (*crassiformis* and *pinal*, Fig. 48a, 52a), or axilla expanded (*crassiformis*, Fig. 48b, d, e), or sternum I with apical depression (*yolo*, compare Fig. 91c, d); labrum flat, in many specimens not protruding beyond clypeus 30

30. Hypostomal carina lamelliform (greatest height equal to about ⅔ of basal width of mandible); setae near hypostomal carina equal to about 0.5 of basal width of mandible; axilla expanded or steplike *paiute*, p. 80

– Hypostomal carina not broadened (except in *lamellatus*); setae near hypostomal carina shorter (except in *idiotrichus*); axilla not expanded or steplike (except in most *crassiformis*) 31

31. Clypeal lip markedly sinuate (Fig. 83a); midscutal setae oriented transversely, forming characteristic pattern (see Fig. 90b, c); punctures many diameters apart laterally and posteriorly to pattern; mesopleural punctures well defined; hindlegs largely red *oasicola* sp. n., p. 113

– Clypeal lip differently shaped; scutal setae oriented uniformly posterad; and/or scutum closely punctate; and/or mesopleuron impunctate, and/or legs black 32

32. Sternum I apicomesally with horizontal depression (Fig. 91c, d) or gradually sloping posterad (Fig. 84b); midscutal setae oriented transversely (posterolaterally in *sonorensis*, some *tsil*, and most *yuma*); mesopleuron punctate (punctures evanescent in some *yolo*) 33

– Different combination of characters: sternum I apicomesally at most with shallow, ill-defined depression; midscutal setae oriented longitudinally to transversely (radially in some *crassiformis*, some *pinal*, and most *opata*); mesopleuron punctate or impunctate 41

33. Clypeal lip undulate or with obtuse, median projection (Fig. 95a, 97a) 34

– Clypeal lip arcuate or sinuate, weakly undulate in some *sonorensis* 35

34. Clypeal lip undulate (Fig. 97a); hypostomal carina in many specimens lamelliform (Fig. 97c) *lamellatus* Pulawski, p. 130

– Clypeal lip undulate or with obtuse, median projection (Fig. 95a); hypostomal carina not lamelliform *arizonae* Pulawski, p. 129

35. Sternum I gradually sloping apically (Fig. 84b; body length 11–13 mm *amplus* W. Fox, p. 115

– Sternum I with horizontal depression apically (Fig. 91c, d); body length 6.5–11.0 mm 36

36. Dense clypeal punctation attaining base of lip laterally, thus bevel not extending laterad to lip corner (Fig. 86a, b) *yolo* Pulawski, p. 117

– Dense clypeal punctation not attaining base of lip laterally, thus bevel extending laterad to lip corner 37

37. Ridges of propodeal side absent anteriorly (Fig. 88b), or fine anteriorly and coarse posteriorly; length of flagellomere IV 3.6–4.2× width *yuma* Pulawski, p. 120

– Propodeal side uniformly ridged; length of flagellomere IV up to 3.2× width 38

38. Mesopleuron beneath scrobe: punctures averaging more than one diameter apart (Fig. 101a, b), setae nearly appressed to nearly erect; scutal setae nearly erect anterolaterally 39

– Mesopleuron beneath scrobe: punctures averaging less than one diameter apart (Fig. 91a, b), setae appressed; scutal setae nearly appressed anterolaterally 40

39. Length 8.0–8.5 mm; Arizona and Mexico (Veracruz and Jalisco states) *tsil* sp. n., p. 131

– Length 9–11 mm; North Dakota and Oregon to Costa Rica *sonorensis* (Cameron), p. 133

40. Clypeal lobe arcuate (Fig. 90a); length of flagellomere I

1.9–2.2 × apical width in eastern and 2.2–2.4 × in western populations; body length 7.5–10.5 mm; United States to central Mexico, transcontinental *texanus* (Cresson), p. 121

- Clypeal lobe sinuate (Fig. 93a); length of flagellomere I 1.9–2.1 × apical width; northwestern Nebraska, Arizona, California, Mexico *huchiti* sp. n., p. 126

41. Setae erect on scape, vertex (Fig. 55b) and scutum, 2.5–3.0 MOD long on vertex, about 2.0 MOD long on scutum anteriorly; mesopleuron dull, with inconspicuous punctures; sterna III–V with graduli; southwestern Texas to southern California, also Mexico (Jalisco) *idiotrichus* Pulawski, p. 85

- Setae appressed or nearly so on scape, appressed or shorter than 1.0 MOD on scutum, no longer than 1.5 MOD on vertex (up to 2.0 MOD long on vertex and scutum in some populations of *psammobius* in which mesopleuron is glossy, coarsely punctate); sterna without graduli 42

42. Metapleuron with oblique carina or lamella emerging from anterior end of flange; flange broadened (Fig. 103d); terga I and II unsculptured apically (Fig. 103e); malar space present (Fig. 103b) 43

- Metapleuron without oblique carina beneath flange; flange not broadened except in some *crassiformis* in which terga I and II are sculptured from base to hindmargin; malar space absent 44

43. Metapleuron with single carina starting beneath anterior end of flange and ending before propodeal spiracle; propodeal side not ridged; setae of propodeal dorsum inclined posterad on broad, basal zone that extends from spiracle to spiracle; hindcoxa not carinate; flagellum partly brown or red; forewing with dark, transverse fascia *psilocerus* Kohl, p. 139

- Metapleuron with oblique lamella emerging from anterior end of flange, and with one or two longitudinal carinae behind lamella (Fig. 103c, d); propodeal side ridged; setae of propodeal dorsum inclined anterad from base to apex except for a few basomedian setae that are inclined posterad; hindcoxa carinate; flagellum black; forewing uniformly colored *scopaeus* sp. n., p. 137

44. Terga I and II unsculptured and glabrous apicomesally; setae of midfemoral venter erect, sparse; flagellum largely brown or red; mespleuron with well-defined punctures *papago* Pulawski, p. 137

- Terga I and II microsculptured and setose from base to hindmargin except in some species in which mesopleuron is impunctate; setae of midfemoral venter appressed or (*psammobius*) erect, dense; flagellum black (except largely red in *pechumani* in which mesopleuron is impunctate) 45

45. Mesopleuron with fine, well-defined punctures, and propodeal side unridged or with microscopic ridges; midscutal setae of most specimens oriented radially, forming rosette-like pattern (see Fig. 105d, e) or (some specimens) midline setae of rosette oriented posterad (see Fig. 90e); basal platform of sternum II in most specimens biemarginate apically (Fig. 75b, c); distance between corners of clypeal lobe about 1.5 × clypeal length) *opata* sp. n., p. 106

- Mesopleuron or propodeal side differently sculptured (propodeal side ridged in many specimens); midscutal setae oriented longitudinally or transversely, but radially in some *crassiformis* and some *pinal* (in which distance between clypeal lip corners is 1.7–2.0 × clypeal length) (Fig. 48a, 52a); basal platform of sternum II acutely angulate to rounded apically, but biemarginate in some *pinal* 46

46. Mesopleuron with well-defined punctures, and either clypeal lip with two lateral incisions or vertex setae 1.1–1.5 MOD long; propodeal side ridged 47

- Mesopleuron differently sculptured; if punctate then either clypeal lip with one lateral incision or not incised, or vertex setae shorter; propodeal side unridged in many specimens 49

47. Clypeal lip with two incisions laterally (Fig. 81a); setae 0.3–0.6 MOD long on vertex *glabrior* Williams, p. 112

- Clypeal lip not incised laterally; setae 1.1–1.5 MOD long on vertex 48

48. Clypeal lip projected mesally (Fig. 77a), bevel in many specimens anteriorly flat or barely concave; body length 8.6–11.0 mm; gaster black *hurdi* R. Bohart, p. 108

- Clypeal lip not projected mesally (Fig. 79a), bevel evenly convex; body length 6–7 mm; gaster red to black *psammobius* Kohl, p. 109

49. Flagellum largely red; clypeus and frons with brassy golden vestiture; Michigan and New Jersey *pechumani* Krombein, p. 50

- Flagellum black; vestiture of clypeus and frons silvery, with golden tinge in some specimens, brassy golden in *bohartorum* (western United States) 50

50. Setae of mesothoracic venter unusually dense (Fig. 59b); in most specimens clypeal lip emarginate (Fig. 59a) and hindfemur and hindtibia red *musciventris* Pulawski, p. 88

- Setae of mesothoracic venter usual; clypeal lip not emarginate and or hindleg black 51

51. Lateral setae of propodeal dorsum oriented posterad, joining apicomesally; propodeal side alutaceous, shiny, with minute punctures (Fig. 65b) *apricus* Pulawski, p. 94

- Lateral setae of propodeal dorsum oriented anterad to laterad, or erect; propodeal side in most species differently sculptured (microareolate, microridged, rugose, or ridged) 52

52. Mesopleuron angulate or weakly carinate between dorsal end of postspiracular carina and anterior end of subalar carina (Fig. 14b); basal half of sternum I with broad, longitudinal keel (Fig. 14c); east of 100th meridian *acutus* Patton, p. 34

- Mesopleuron not angulate or carinate between postspiracular carina and subalar carina; sternum I at most with longitudinal carina 53

53. Clypeal lip arcuate, with two incisions laterally (Fig. 73a); mesopleuron and propodeal side uniformly microareolate, impunctate, propodeal hindface contrastingly ridged; hindcoxa with expanded carina basally; pygidial plate broader apically (Fig. 73c) *verticalis* Pulawski, p. 104

- Clypeal lip with one lateral incision or not incised (two incisions laterally in *crenulatus* and *spatulifer* in which hindcoxal carina, if present basally, is not expanded);

mesopleuron and/or propodeum in most specimens differently sculptured; pygidial plate narrower 54

54. Fore- and midfemoral venter with large, sparse punctures, without micropunctation (Fig. 8c, d); vertex setae about 0.6 MOD long anteriorly and 0.3 MOD long posteriorly; wings strongly infumate; pygidial plate of most specimens punctatorugose (Fig. 8b) *aethiops* (Cresson), p. 26

– Fore- and midfemoral venter densely micropunctate; or (*mirandus, tipai*) sparsely punctate and without micropunctures, but then vertex setae erect, about 1.0 MOD long and wings hyaline to moderately infumate; pygidial plate alutaceous or punctate 55

55. Forecoxa with apical process (Fig. 25b, c, 29b, c); tarsomeres IV and V elongate (Fig. 25d, e, 29d, e); femora and tibiae black 56

– Forecoxa without apical process and/or tarsomeres IV and V not elongate or (*occidentalis*) hindfemur and hindtibia all or partly red 57

56. Clypeus and frons with brassy golden vestiture; clypeal lip deeply incised laterally (Fig. 29a) *bohartorum* Pulawski, p. 51

– Clypeus and frons with silvery vestiture; clypeal lip shallowly incised laterally (Fig. 25a) *hopi* sp. n., p. 47

57. Mesopleuron coarsely punctatorugose or rugose; trochanteral venter sparsely punctate in most specimens *irregularis* Pulawski, p. 55

– Mesopleuron finely sculptured (microareolate to finely punctate); if finely rugose (many *powelli*) then trochanteral venter densely punctate 58

58. Clypeal lip with several shallow concavities (Fig. 39b, 41b), its free margin dentate or undulate (Fig. 39a, 41a) or (some *spatulifer*) with obtuse projection mesally 59

– Clypeal lip flat or (some specimens) with a few vestigial concavities, its free margin arcuate or obtusely angulate 60

59. Clypeal lip obtusely prominent mesally (Fig. 39a); trochanteral venter densely punctate *spatulifer* Pulawski, p. 63

– Clypeal lip emarginate mesally (Fig. 41a), emargination flanked by obtuse projection (emargination rudimentary or absent in some individuals); mid- and hindtrochanteral venter sparsely punctate *crenulatus* W. Fox, p. 65

60. Terga II–IV glabrous (except laterally), nonfasciate apically; fore- and midfemoral venter sparsely punctate, without micropunctation; basal platform of sternum II broad apically *mirandus* Pulawski, p. 102

– Terga II–IV finely setose throughout; if glabrous (some *semirufus*) then fore- and midfemoral venter densely punctate (setae inconspicuous in some *tipai* in which basal platform of sternum II is angulate apically) 61

61. Punctures of mesothoracic venter many diameters apart on each side of midline; length of flagellomere II 3.5–4.0× width; all setae of propodeal dorsum oriented anterad along midline or (some individuals) a few basomedian setae oriented posterad *tipai* sp. n., p. 99

– Punctures of mesothoracic venter no more than one diameter apart and/or flagellomere II shorter; basomedian setae of propodeal dorsum oriented posterad or (*semirufus*) all setae erect 62

62. Hindfemur and hindtibia all or partly red; clypeal lip evenly arcuate, not incised laterally (Fig. 61a, 63a); propodeal side unridged or with microscopic ridges when seen from certain angles 63

– Hindfemur and hindtibia in most specimens black; if red (some *antennatus*, some *crassiformis*) then clypeal lip incised laterally and propodeal side in most specimens ridged 64

63. Humeral plate of forewing uniformly yellowish, contrasting with dark median plate; mesopleuron minutely punctate, but mesopleural vestiture largely concealing integument; most setae of propodeal dorsum oriented transversely *solaris* Pulawski, p. 93

– Humeral plate of forewing yellowish anteriorly and dark posteriorly, not contrasting with median plate; mesopleuron impunctate, mesopleural vestiture not concealing integument; most setae of propodeal dorsum oriented anterolaterad *occidentalis* Pulawski, p. 91

64. Sternum II uniformly micropunctate and setose from base to apex; mesopleuron and propodeal side and hindface uniformly densely microareolate; middle clypeal section of many specimens densely punctate from frontoclypeal suture to lip (Fig. 33a); mesopleural setae appressed *laevifrons* (F. Smith), p. 56

– Sternum II impunctate and glabrous on apical depression; mesopleuron differently sculptured from propodeal side and/or hindface; clypeus with sparsely punctate bevel; mesopleural setae appressed to erect 65

65. Setae of propodeal dorsum erect or nearly so in lateral view and about 1.0 MOD long (Fig. 19c); terga not fasciate *semirufus* (Cresson), p. 40

– Setae of propodeal dorsum erect or inclined anterad in lateral view, no longer than 0.7 MOD; terga of many specimens fasciate 66

66. Mesopleuron with fine but conspicuous microsculpture, with minute, sparse punctures (Fig. 21c, 50b) 67

– Mesopleuron without conspicuous microsculpture, its punctures larger and/or denser, or mesopleuron impunctate, punctatorugose, or (many *powelli*) slightly rugose 69

67. Vertex width 1.6–1.8× length; gena thick in dorsal view (Fig. 21b); setae below mesopleural scrobe markedly shorter than MOD; terga not fasciate; western North America *pauxillus* W. Fox, p. 42

– Vertex width 0.9–1.0× length; gena thin in dorsal view; setae below mesopleural scrobe about 1.0 MOD long; terga I–IV fasciate apically; Caribbean Islands 68

68. Clypeal lip without median projection; gaster black basally, red apically; Cuba and Jamaica *cubanus* Pulawski, p. 77

– Clypeal lip with obtuse, median projection (Fig. 50a); gaster red except terga I–III with black, median strip; eastern Cuba, Hispaniola *dominicanus* sp. n., p. 79

69. Trochanteral venter impunctate; vertex width 1.4–1.9× length; setae of postocellar impression about 1.0 MOD long; clypeal lip incised laterally; silvery tergal fasciae inconspicuous *eldoradensis* Rohwer, p. 46

– Trochanteral venter closely punctate to impunctate; if impunctate, then vertex narrower and or clypeal lip not incised laterally, or (*orestes*) setae of postocellar impression 0.5 MOD long or less and silvery tergal fasciae well defined 70

70. Clypeal lip obtusely triangular mesally (Fig. 12a) *angelicus* sp. n., p. 33

– Clypeal lip not triangular mesally 71

71. Fore- and midfemoral venter micropunctate and also with large, sparse punctures (Fig. 6b, c) *montanus* (Cresson), p. 25

– Fore- and midfemoral venter densely micropunctate, at most with a few large punctures basally 72

72. Setae erect or nearly so on mesopleuron, erect on vertex *powelli* R. Bohart, p. 38

– Setae inclined posterad or appressed on mesopleuron, appressed to erect on vertex 73

73. Hypoepimeral setae appressed or nearly so (Fig. 34b), inclined adjacent to subalar fossa in some individuals; clypeal lobe (Fig. 34a) of usual width (distance between lip corners 1.4–1.6 × clypeal length); axilla simple; gaster all or partly red, but all black in some specimens from Pacific Coast 74

– Hypoepimeral setae inclined to erect, but if appressed (many *antennatus*, many *crassiformis*), then distance between clypeal lip corners 1.7–2.5 × clypeal length, and axilla steplike or expanded in most *crassiformis*, or (many *krombeini*) gaster all black and occurring in southeastern United States 75

74. Transcontinental *tarsatus* (Say), p. 57

– West Coast to 100th meridian; morphologically inseparable from *tarsatus* *williamsi* R. Bohart, p. 62

75. Pygidial plate markedly alutaceous, at least basally (Fig. 45b); gaster black; Florida to North Carolina and Alabama *krombeini* Kurczewski, p. 70

– Pygidial plate at most weakly alutaceous; gaster in most specimens all or partly red 76

76. Clypeal lobe broad (distance between its corners 1.7–1.9 × clypeal length, as on Fig. 52a and 54a); vertex setae erect, about 1.0 MOD long; clypeal lobe arcuate (Fig. 52a, 54a) 77

– Clypeal lobe narrower, or vertex setae appressed or nearly so, or (*tahoe*) clypeal lip slightly sinuate (Fig. 57a) 78

77. Vertex width 1.3–1.5 × length; gaster black basally, red apically; central Mexico *toltec* sp. n., p. 83

– Vertex width 1.0–1.1 × length; gaster red; California and New Mexico to Sonora, Mexico *pinal* sp. n., p. 81

78. Free margin of clypeal lobe weakly arcuate or sinuate, nearly straight; lobe in most specimens unusually broad (Fig. 46a, 48a), width 1.8–2.5 × clypeal length (1.7 × in some *crassiformis* but then axilla expanded); propodeal dorsum not sloping or scarcely sloping toward transverse carina that separates it from hindface (sloping just above median groove of hindface); carina well defined at least mesally 79

– Free margin of clypeal lobe arcuate, sinuate, or shallowly emarginate; lobe width 1.4–1.7 × clypeal length; axilla simple; propodeal dorsum sloping toward transverse carina that separates it from hindface (carina evanescent in many specimens) 80

79. Axilla in most specimens expanded into lobe which may be large (overhanging lateral fossa) or small, steplike (Fig. 48b–e); mesopleural setae partly hiding integument, averaging about 0.8 MOD just below scrobe; setae of propodeal dorsum oriented anterad along midline (only a few such setae present in some individuals) *crassiformis* Viereck, p. 75

– Axilla not expanded; setae either shorter and not concealing sculpture on mesopleuron or oriented anterolaterad on propodeal dorsum (parted mesally) *antennatus* W. Fox, p. 72

80. Clypeal lip evenly arcuate, not incised laterally (Fig. 43a); setae appressed on vertex and along hypostomal carina; foretarsomere I with 3–6 rake spines (no more than 3 apical spines with confluent or contiguous basal fossae), foretarsomere II with 2–4 rake spines (Fig. 43b); body length 5.0–7.5 mm *miwok* sp. n., p. 67

– Clypeal lip sinuate or incised laterally, and/or body length over 7.5 mm (6.5–11.0 mm); setae appressed to erect on vertex, suberect to erect along hypostomal carina; foretarsomere I and II of many specimens with more than 6 and 4 rake spines, respectively; body length 6.5–11.0 mm 81

81. Clypeal lip not incised laterally (Fig. 67a); setae appressed or nearly so on vertex, erect and 1.3 MOD long along hypostomal carina posteriorly, almost erect on hypoepimeral area, and appressed below mesopleural scrobe; mandibular outer face in most specimens with longitudinal sulcus beyond notch (Fig. 67c, d) *sulcatus* sp. n., p. 97

– Clypeal lip in many specimens incised laterally; setae different; mandibular outer face without sulcus or with rudimentary sulcus 82

82. Clypeal lip weakly sinuate, not incised laterally (Fig. 57a); vertex setae erect; body length 6.5–8.0 mm *tahoe* sp. n., p. 86

– Clypeal lip not sinuate, incised laterally in most specimens; vertex setae appressed to erect; body length 7–11 mm 83

83. Gaster red basally, black apically or (some specimens) all black *pompiliformis* (Panzer), p. 20

– Gaster all red 83

84. Clypeal lip emarginate mesally; mandibular ventral margin convex basally; trochanteral venter shiny, in most specimens sparsely punctate or impunctate *orestes* sp. n., p. 31

– Clypeal lip not emarginate mesally; mandibular ventral margin straight or concave basally; trochanteral venter sparsely to densely punctate undescribed species and/or red phase of *pompiliformis*

♂♂

(*Tachysphex orestes* not included)

1. Vertex width less than length; distance between clypeal lobe corner and orbit about twice distance between corners (Fig. 148a); sterna IV–VI all or largely asetose; forefemoral notch margined anteriorly and posteriorly (Fig. 148c, d, 150c), its surface slightly raised above adjacent area (*julliani* group) 3

– Vertex width equal to length or more, or clypeal lobe broader; sterna IV–VI densely setose (but largely asetose in *alayoi, iridipennis, menkei,* and *mirandus*); forefemoral notch in most species not margined 2

2. Vertex with callosity behind each hindocellus (Fig. 114a); if callosities indistinct (some *clarconis*), then vertex width more than twice length and foretarsal rake present; setae of propodeal dorsum inclined anterad (*terminatus* group) 4

– Vertex without callosities or, if callosities present (some *iridipennis*), setae of propodeal dorsum slightly inclined posterad; vertex width less than twice length and/or foretarsal rake absent (*brullii* and *pompiliformis* groups) 12

julliani species group

3. Vertex setae appressed or nearly so; propodeal side unridged or finely ridged posteriorly; gastral apex brown *coquilletti* Rohwer, p. 200

– Vertex setae erect; propodeal side ridged, ridges rarely evanescent; gaster red, exceptionally black apically *cockerellae* Rohwer, p. 204

terminatus species group

4. Forefemur entire; Caribbean Islands 5

– Forefemur notched; continental America and Bahamas 6

5. Upper metapleuron with longitudinal carina that starts at about midlength of flange and ends before propodeal spiracle *antillarum* Pulawski, p. 149

– Upper metapleuron with toothlike, prespiracular prominence (see Fig. 114b–d) *quisqueyus* sp. n., p. 156

6. Foretarsal rake absent and clypeus broad (width 3.2–3.6 × length); upper metapleuron with longitudinal carina (with few longitudinal ridges in some specimens) that starts beneath anterior end of flange and ends before propodeal spiracle (Fig. 109b); metapleural flange broad; Arizona and southern California to Argentina *ruficaudis* (Taschenberg), p. 149

– Foretarsal rake present; if absent (most *apicalis*), then clypeus narrow (width 2.1–2.3 × length) or (some *linsleyi*) upper metapleuron distinctive (Fig. 112a–c) 7

7. Foretarsal rake absent; if present (some southeastern specimens), then propodeum strongly sculptured between dorsum and side (Fig. 118e); clypeal width 2.0–2.3× length *apicalis* W. Fox, p. 164

– Foretarsal rake present; if absent (some *linsleyi*), then upper metapleuron distinctive (Fig. 112a–c); propodeum finely sculptured between dorsum and side; clypeus broader (except in *alpestris* and *similis*) 8

8. Upper metapleuron with few simple ridges before propodeal spiracle; metapleural flange narrow, oblique carina beneath its anterior end vestigial or absent; graduli shallow, not invaginated; gaster red or black *clarconis* Viereck, p. 147

– Upper metapleuron with prominence, lamella, or at least a low carina (which is angulate posteriorly) in front of propodeal spiracle; metapleural flange broad, with oblique carina beneath its anterior end; graduli deeply invaginated (except apically) underneath basal, triangular area in front of them; gaster in most specimens black (red in certain populations of *alpestris*) 9

9. Prespiracular prominence of upper metapleuron rounded apically, funnel-shaped (Fig. 112a–c); oblique carina beneath anterior end of metapleural flange as high as flange or nearly so *linsleyi* R. Bohart, p. 153

– Prespiracular carina or prominence of upper metapleuron acutely angulate at apex; oblique carina beneath anterior end of metapleural flange lower than flange 10

10. Prespiracular prominence of upper metapleuron low, obtusely angulate (Fig. 111b–d), its anterior margin markedly longer than the posterior *alpestris* Rohwer, p. 151

– Prespiracular prominence of upper metapleuron large, toothlike, its anterior and posterior margins about equal in length (Fig. 114b–d, 116b–d) 11

11. Scutal setae about 1.3 MOD long anterolaterally; sculpture not totally obscured by vestiture between antennal socket and orbit; frons in most specimens with ill-defined punctures; vertex width 1.6–2.2 × length *similis* Rohwer, p. 161

– Scutal setae about 2.0 MOD long anterolaterally; sculpture in most specimens obscured by vestiture between antennal socket and orbit; frons in most specimens with well-defined punctures; vertex width 2.0–2.5 × length *terminatus* (F. Smith), p. 156

brullii and *pompiliformis* species groups

12. Setae of propodeal dorsum inclined posterad, or median setae oriented anterad while lateral setae oriented posterad and joining apicomesally; or setae erect and mesopleural punctures well defined 13

– Setae of propodeal dorsum inclined anterad, anterolaterad, or laterad; or (*maya*) posteriorly oriented setae broadly separated and not joining apicomesally, or setae erect and mesopleuron impunctate 27

13. Sterna simple; forefemoral notch of most specimens compressed, its glabrous bottom crestlike (Fig. 65e) *apricus* Pulawski, p. 94

– Sterna III–V with graduli or transverse sulcus; forefemoral notch not compressed, its bottom not crestlike 14

14. Propodeal dorsum longitudinally ridged or irregularly rugose (Fig. 128b, 141b), at least basally 15

– Propodeal dorsum evenly microreticulate (Fig. 120d, e) 18

15. Vertex width less than length; setae appressed on vertex and scutum; mesopleural punctures less than one diameter apart; tibiae red *belfragei* (Cresson), p. 180

– Vertex width more than length; setae erect on vertex and scutum, at least 1.0 MOD long; mesopleural punctures one diameter or more apart, at least posteriorly; tibiae black or (*alayoi*) partly red 16

16. Setae of propodeal dorsum inclined anterad on basomedian area; propodeal side with well-defined ridges; hindcoxa with basal tooth; gastral apex red in most specimens; West Indies, Florida *alayoi* Pulawski, p. 198

– Setae of propodeal dorsum erect or inclined obliquely posterad; propodeal side not ridged; if ridged (*iridipennis*) then hindcoxa without basal tooth; gaster black 17

17. Clypeal lobe: distance between corners less than distance between corner and orbit (Fig. 144e); scutal setae 2.0 MOD long; propodeal side ridged (ridges probably eva-

nescent in some specimens); sterna III–VI sparsely punctate; hindcoxa without basal tooth *iridipennis* (F. Smith), p. 196

– Clypeal lobe: distance between corners at least equal to distance between corner and orbit (Fig. 141e); scutal setae 1.0–1.2 MOD long; propodeal side at most partly ridged; sternal punctures nearly contiguous; hindcoxa with basal tooth (Fig. 141c) *inconspicuus* (Kirby), p. 193

18. Setae 1.6–2.5 MOD long on lower gena and anterolaterally on scutum; sterna III–VI impunctate, glabrous; scutal and mesopleural punctures several diameters apart *menkei* Pulawski, p. 184

– Setae 0.5–0.8 MOD long on lower gena, very short and appressed (or nearly so) on scutum; sterna punctate and pubescent throughout; in most specimens scutal and mesopleural punctures less than one diameter apart 19

19. Clypeal vestiture totally concealing sculpture (except on lip); midscutal setae oriented laterad (except on midline); sterna III–VI (except laterally) with straight transverse sulcus (which is visible only when segments are fully extended) 20

– Clypeal integument easily visible on bevel; scutal setae oriented posterad; sterna III–VI with graduli 22

20. Mesopleural vestiture not concealing sculpture; sternum II flat *armatus* Pulawski, p. 191

– Mesopleural vestiture partly concealing sculpture; sternum II somewhat swollen along foremargin of apical depression (morphologically indistinguishable males of two species) 21

21. Northern half of Mexico north to Texas, Colorado, Utah, Nevada, and California *acanthophorus* Pulawski, p. 187

– Known from southeastern California, Arizona, and Sonora, Mexico *cocopa* sp. n., p. 191

22. Tibiae red 23

– Tibiae all or largely black 24

23. Penis valve: Figure 131a, b; vertex setae appressed; mesopleural vestiture golden in fresh specimens; hindfemur red in apical third; gaster red basally *krombeiniellus* Pulawski, p. 181

– Penis valve: Figure 121g, h; vertex setae erect or inclined (at least partly); mesopleural vestiture silvery; hindfemur black; gaster all black or basally red *mundus* W. Fox, p. 169

24. Setae of sterna IV–VI extending beyond sternal hindmargin and forming short apical fasciae (Fig. 125e) *robustior* Williams, p. 176

– Sterna without apical, setal fasciae 25

25. Gaster red basally; frontal vestiture golden or (some specimens) silvery; clypeal lobe: distance between corners equal to about 1.25 of clypeal length (Fig. 123e); British Columbia to Chiapas, in United States west of the 103rd meridian *aequalis* W. Fox, p. 172

– Gaster black; frontal vestiture silvery; clypeal lobe: distance between corners equal to 1.0–1.25 of clypeal length; east of the Rocky Mountains 26

26. Midscutal punctures less than one diameter apart; axilla steplike, overhanging lateral (subvertical) portion *utina* sp. n., p. 179

– Midscutal punctures more than one diameter apart (most specimens) to slightly less than one diameter apart; axilla not steplike *maurus* Rohwer, p. 177

27. Subalar fossa carinate below (Fig. 16a, b); upper mesopleuron longitudinally ridged; postspiracular carina unusually long; east of Rocky Mountains, also Idaho *punctifrons* W. Fox, p. 37

– Subalar fossa not carinate below; mesopleuron not ridged; postspiracular carina shorter (except in *acutus*) 28

28. Midscutal setae oriented radially, forming a rosettelike pattern (Fig. 105d, e); clypeal free margin shallowly concave between lobe and orbit (Fig. 105f) and distance between lip corners about 1.3× clypeal length; labrum convex and protruding beyond clypeus in nearly all specimens (Fig. 105b, c); axilla of usual shape; sternum I without apical depression, basal plate of sternum II angulate; sterna III–VI with well-defined graduli that delimit a triangular area (graduli visible only when sterna are fully extended) *ashmeadii* W. Fox, p. 141

– Midscutal setae oriented longitudinally to transversely, but not radially; if radially, then with following characters: clypeal free margin deeply concave between lobe and orbit, basal plate of sternum II rounded or biemarginate, and graduli absent (*opata*), or distance between clypeal lobe corners is 1.5–1.6× clypeal length (*crassiformis* and *pinal*), or axilla expanded (*crassiformis*), or sternum I with an apical depression and graduli absent (*yolo*); labrum flat, in most specimens not protruding beyond clypeus 29

29. Hypostomal carina lamelliform, its greatest height equal to about ⅔ of basal width of mandible; setae near hypostomal carina equal to about 0.5 of basal width of mandible; axilla expanded or steplike; clypeal lobe broad, its free margin nearly straight (Fig. 51b) *paiute* sp. n., p. 80

– Hypostomal carina not lamelliform (except in *lamellatus*); setae near hypostomal carina shorter (except *idiotrichus*); axilla not expanded or steplike except in most *crassiformis*; clypeal lobe in most species differently shaped 30

30. Clypeal lip sinuate (Fig. 83b); midscutal setae oriented transversely, forming characteristic pattern (see Fig. 90c); punctures several diameters apart laterally and posteriorly to pattern; mesopleural punctures well defined *oasicola* sp. n., p. 113

– Clypeal lip differently shaped, and/or scutal setae oriented posterad, and/or scutal punctures close to each other, and/or mesopleuron impunctate 31

31. Sternum I apicomesally with horizontal depression (Fig. 91c, d), or gradually sloping posterad (Fig. 84b); midscutal setae oriented transversely (Fig. 90b, c), posterolaterally in *sonorensis*, some *tsil*, and most *yuma*; mesopleuron punctate (punctures evanescent in some *yolo*) 32

– Different combination of characters: sternum I apicomesally at most with shallow, ill-defined depression; midscutal setae oriented longitudinally to transversely; mesopleuron punctate or impunctate 40

32. Clypeal lip triangular (Fig. 93b, 97b, 101c), free margin not angulate between lip and lateral section; mandibular inner margin not dentate 33

– Clypeal lip arcuate, concave, or tridentate, free margin angulate between lip and lateral section; mandibular inner margin with tooth (except not dentate in *yolo*) 35

33. Length of flagellomere III about 0.75 of IV (Fig. 101e);

sternal pubescence not velvety; forebasitarsus with preapical rake spines *sonorensis* (Cameron), p. 133

– Length of flagellomere III 0.9–1.0 of IV; sternal pubescence velvety (thin in *lamellatus*); foretarsus without rake 34

34\. Scutal setae nearly erect, 1.3 MOD long anterolaterally; sternal pubescence not concealing integument; in many specimens hypostomal carina lamelliform and adjacent gena ridged (Fig. 97c) *lamellatus* Pulawski, p. 130

– Scutal setae nearly appressed, shorter than MOD anterolaterally; sternal pubescence concealing integument or nearly so; hypostomal carina not lamelliform, gena not ridged *huchiti* sp. n., p. 126

35\. Sternum I at apex with gradually sloping surface (Fig. 84b); dorsal length of flagellomere I 1.7–2.0 × apical width (Fig. 84d); body length 8.5–11.0 mm *amplus* W. Fox, p. 115

– Sternum I at apex with horizontal depression; dorsal length of flagellomere I 1.1–1.9 × apical width; body length 5–11 mm 36

36\. Clypeal lip markedly sinuate (Fig. 99); distance between lip corners about 0.6 of distance between corner and orbit *tsil* sp. n., p. 131

– Clypeal lip arcuate, concave, or sinuate (Fig. 90e); distance between lip corners more than distance between lip corner and orbit or slightly less 37

37\. Sternal pubescence not velvety *yolo* Pulawski, p. 117

– Sternal pubescence velvety 38

38\. Clypeal lobe broader (Fig. 88c): lip corners markedly closer to orbit than to each other; propodeal side not ridged or not ridged anteriorly but ridged posteriorly (Fig. 88b); length of flagellomere IV 2.0–2.4 × width *yuma* Pulawski, p. 120

– Clypeal lobe narrower: lip corners about as distant from orbit as from each other; propodeal side uniformly ridged; length of flagellomere IV up to 2.0 × width 39

39\. Lip corners more prominent (Fig. 95b), lip base slightly concave, therefore bevel semilunate; setae suberect beneath mesopleural scrobe; southwestern United States, Mexico *arizonac* Pulawski, p. 129

– Lip corners less prominent (Fig. 90d, e), lip base straight, bevel not semilunate; setae appressed or nearly so beneath mesopleural scrobe; United States to central Mexico, transcontinental *texanus* (Cresson), p. 121

40\. Setae erect on scape, vertex (Fig. 55b), and scutum; setae 2.2–3.0 MOD long on vertex, 1.5 MOD on scutum anteriorly; vertex width more than twice length; mesopleuron dull, with inconspicuous punctures; forefemoral notch compressed (its glabrous bottom crestlike); southwestern Texas to southern California, Mexico (Jalisco) *idiotrichus* Pulawski, p. 85

– Setae appressed on scape, appressed or shorter than MOD on scutum; no longer than 1.5 MOD on vertex (up to 2.0 MOD long on vertex and scutum in some *psammobius* in which mesopleuron is glossy, coarsely punctate); vertex width in most specimens less than twice length; forefemoral notch not compressed 41

41\. Setae of sterna VI–VIII erect, about 1.0 MOD long (Fig. 35a, b); setae of gonoforceps and volsella woolly (Fig. 35c, d); hypoepimeral setae appressed (Fig. 34b); transcontinental except Florida *tarsatus* (Say), p. 57

– Sternal setae appressed or (*williamsi*) setae of sterna VI and VIII erect, about 0.4 MOD long; setae of gonoforceps and volsella straight; setae of hypoepimeral area in most species inclined to erect 42

42\. Metapleuron with oblique carina or lamella emerging from anterior end of flange; flange broadened (Fig. 103d); tergum I and II unsculptured apically (Fig. 103e); setae of midfemoral venter erect, sparse; malar space present (Fig. 103b) 43

– Metapleuron without carina or lamella below flange; flange narrow or if broadened (many *crassiformis*) than tergum I and II sculptured from base to apex; setae of midfemoral venter appressed to erect; malar space absent 44

43\. Metapleuron with single carina that starts beneath anterior end of flange and ends before propodeal spiracle; propodeal side not ridged; setae of propodeal dorsum inclined posterad basally on broad zone that extends from spiracle to spiracle; hindcoxa not carinate; flagellomere III almost as long as IV; forewing with weak, transverse fascia *psilocerus* Kohl, p. 139

– Metapleuron with oblique lamella emerging from anterior end of flange (Fig. 103c, d), and with one or two longitudinal carinae behind lamella; propodeal side ridged; setae of propodeal dorsum inclined anterad from base to apex except a few basomedian setae that are inclined posterad; hindcoxa carinate; length of flagellomere III about 0.75 of IV; forewing uniformly colored *scopaeus* sp. n., p. 137

44\. Tergum I and II unsculptured and glabrous apicomesally (see Fig. 103e); mesopleuron with well-defined punctures; setae of midfemoral venter erect, about 1.0 MOD long *papago* Pulawski, p. 137

– Tergum I and II sculptured and setose from base to hindmargin; mesopleuron punctate to impunctate; setae of midfemoral venter appressed to (many *psammobius*) erect, dense 45

45\. Clypeal lip sharply pointed to obtusely triangular; mandibular inner margin not dentate or with vestigial tooth (Fig. 12b, 39c, 41c, 57d, 59c, 69e, 71c, 79c) 46

– Clypeal lip arcuate, sinuate, rounded, truncate, or with concave free margin; mandibular inner margin with tooth except not dentate in *occidentalis*, *sulcatus*, and *tipai* (males of *tipai* run either to 46 or to 53 because of varying clypeus shape) 53

46\. Pubescence of sterna III–VI velvety, largely or totally concealing integument except apically (Fig. 59d, e) 47

– Sternal pubescence not velvety, not obscuring integument 48

47\. Vertex width 1.3–2.0 × length; hypoepimeral setae appressed; pubescence of sternum II velvety *musciventris* Pulawski, p. 88

– Vertex width 1.1–1.4 × length; hypoepimeral setae nearly erect; pubescence of sternum II not velvety *tahoe* sp. n., p. 86

48\. Sterna II–VI largely glabrous and sparsely punctate mesally; punctures larger on lateral clypeal section than on adjacent frons *mirandus* Pulawski, p. 102

– Sterna densely punctate and setose; punctures of same size on lateral clypeal section and adjacent frons 49

49\. Propodeal dorsum irregularly ridged to rugose; mesopleuron punctate (punctures ill defined in some specimens); vertex setae erect *psammobius* (Kohl), p. 109

– Propodeal dorsum microareolate; mesopleuron at most with inconspicuous punctures; vertex setae appressed to erect 50

50. Length of flagellomere II 2.25–2.5 × width; median setae of propodeal dorsum oriented anterad or (some specimens) a few basomedian setae oriented posterad; punctures of mesothoracic venter many diameters apart on each side of midline to (some specimens) no more than one diameter apart; vertex setae erect *tipai* sp. n., p. 99

– Length of flagellomere II 1.6–2.2 × width; basomedian setae of propodeal dorsum oriented posterad on about 0.25 of its length; punctures of mesothoracic venter no more than one diameter apart; vertex setae appressed to (some *crenulatus*) erect 51

51. Clypeal lip obtusely triangular to markedly sinuate (Fig. 12b); length of flagellomere II 2.0–2.2 × width *angelicus* sp. n., p. 33

– Clypeal lip pointed (Fig. 39c, 41c); length of flagellomere II 1.6–1.8 × width 52

52. Punctures of mid- and hindtrochanteral venter several diameters apart to (some specimens) nearly contiguous; corners of clypeal lip closer to each other than to orbits (Fig. 41c); frontal vestiture silvery *crenulatus* W. Fox, p. 65

– Trochanteral punctures nearly contiguous; corners of clypeal lip closer to orbits than to each other (Fig. 39b) in most specimens; frontal vestiture golden in most if not all specimens *spatulifer* Pulawski, p. 63

53. Forefemur not emarginate; mandibular inner margin roundly emarginate (Fig. 50c, d); eastern Cuba, Hispaniola *dominicanus* sp. n., p. 79

– Forefemur emarginate basally; mandibular inner margin not emarginate (except in *cubanus*) 54

54. Vertex longer than wide (width : length ratio = 0.7–0.9); midscutal setae oriented posterad; clypeal free margin markedly concave between lobe and orbit (Fig. 73d); sterna III–VI with well-defined graduli (graduli visible only when sterna are fully extended) 55

– Vertex wider than long; if as wide as long (some *opata*) then midscutal setae oriented radially or transversely, or (some *solaris*) clypeal free margin shallowly concave between lobe and orbit; well-defined graduli present in *glabrior* and *irregularis* 56

55. Clypeal bevel absent or dull, indistinct (Fig. 73d); mesopleuron and propodeal side uniformly microareolate; hindcoxa markedly expanded basodorsally; western United States, northern Mexico (including Baja California) *verticalis* Pulawski, p. 104

– Clypeal bevel well defined, shiny (Fig. 135b); mesopleuron and propodeal side punctate; hindcoxa barely expanded basodorsally; southern half of Mexico, Costa Rica *maya* sp. n., p. 186

56. Mesopleuron with well-defined punctures; propodeal side ridged; gaster black; foretarsal rake absent; and also with characters given under couplet 57 below 57

– Mesopleuron impunctate, with ill-defined punctures, or punctatorugose to rugose; if with well-defined punctures (some specimens), then propodeal side not ridged, or not agreeing with characters given under couplet 57 below 58

57. Clypeal lip (Fig. 77b): distance between corners equal to distance between corner and orbit or slightly less; vertex setae 1.5 MOD long; punctures coarser on mesopleuron than on mesothoracic venter; graduli absent *hurdi* R. Bohart, p. 108

– Clypeal lip (Fig. 81b): distance between corners about 1.25 of distance between corner and orbit; vertex setae 0.3–0.6 MOD long; punctures as fine on mesopleuron as on mesothoracic venter; sterna III–V with graduli *glabrior* Williams, p. 109

58. Midscutal setae oriented radially, forming a rosettelike pattern (as in *ashmeadii*, Fig. 105d, e), but in some individuals midline setae oriented contrastingly posterad (as in *texanus*, Fig. 90b, c); distance between clypeal lobe corners 1.2 × clypeal midline (Fig. 75d); axilla the usual shape; mesopleuron finely, evenly punctate; propodeal side not ridged, glabrous along metapleuron *opata* sp. n., p. 106

– Midscutal setae oriented longitudinally or transversely, but if radially (some *crassiformis*, some *pinal*) then distance between clypeal lip corners 1.5–1.8 × clypeal midline and axilla expanded in *crassiformis*; mesopleuron and/or propodeal side differently sculptured or propodeal side setose throughout 59

59. Mesopleuron punctatorugose to rugose, punctate beneath; hindcoxa carinate basally; sternal punctures conspicuous, about as large as those on mesothoracic venter; sterna III–VI with well-developed graduli *irregularis* Pulawski, p. 55

– Mesopleuron microareolate, at most with inconspicuous punctures, weakly rugose in some *powelli* in which hindcoxa is not carinate; sternal punctures of most species smaller than those of mesothoracic venter; graduli absent or inconspicuous 60

60. Humeral plate of forewing yellowish or (some individuals) with small, dark spot, contrasting with dark median plate; clypeal free margin not angulate or indistinctly angulate between lip and lateral section (Fig. 63b); most setae of propodeal dorsum oriented transversely *solaris* Pulawski, p. 93

– Humeral plate of forewing dark brown to black or (some species) yellowish anteriorly, not contrasting with median plate; clypeal free margin (except in *occidentalis* and *tipai*) angulate between lip and lateral section; setae of propodeal dorsum oriented anterad or anterolaterad 61

61. Clypeal free margin not angulate or scarcely angulate between lip and lateral section (Fig. 61b, 67e, 69e), lobe ill defined laterally; mandibular inner margin not dentate or with vestigial tooth 62

– Clypeal free margin angulate between lip and lateral section, lobe well defined laterally; mandibular inner margin with tooth 64

62. Clypeal lobe narrow, distance between lip corners about 0.6–0.8 distance between corner and orbit (Fig. 61b); sternal punctures as large as those on mesothoracic venter or larger; apical depression of sterna II–V impunctate (Fig. 61c) *occidentalis* Pulawski, p. 91

– Clypeal lobe broader, distance between lip corners 0.9–

1.0 distance between lip corner and orbit; sterna punctate throughout, punctures finer than on mesothoracic venter 63

63. Vertex width 1.4–1.6 × length, vertex setae erect; length of flagellomere II 2.25–2.5 × width; mesopleural setae suberect to subappressed below scrobe; punctures of mesothoracic venter less than one diameter to many diameters apart on each side of midline *tipai* sp. n., p. 99

– Vertex width 1.1 × length, vertex setae nearly appressed; length of flagellomere II 2.0 × width; mesopleural setae appressed beneath scrobe; punctures of mesothoracic venter less than one diameter apart *sulcatus* sp. n., p. 97

64. Vertex width 2.1–2.3 × length (Fig. 27c); corners of clypeal lip (Fig. 27b) about as far from each other as from orbit (ratio: 0.9–1.0); mesopleural setae markedly inclined beneath scrobe; terga I–IV fasciate apically; body length 6–10 mm; Michigan, New Jersey *pechumani* Krombein, p. 50

– Vertex width less than twice length; if 2.0–2.1 × length (some *antennatus*, some *krombeini*), then corners of clypeal lip markedly closer to orbits than to each other (ratio: 1.5–1.6), or (some *powelli*) mesopleural setae erect or nearly so beneath scrobe and terga not fasciate 65

65. Corners of clypeal lip (Fig. 6d, 8e, 23, 25f, 29f) closer to each other than to orbit (as 0.45–0.8:1), but equidistant in some *aethiops* (ratio 0.8–1:1); in latter species clypeal lobe delimited laterally by well-defined carina that extends dorsad slightly beyond lip base (Fig. 8f) 66

– Corners of clypeal lip closer to orbit than to each other (as 1.2–1.4:1), but as 0.9–1.3:1 in *pompiliformis*; in latter species clypeal lobe delimited laterally by evanescent carina that does not extend dorsad beyond lip base (Fig. 4c) 70

66. Tergal punctures uniformly, excessively dense (Fig. 30a, b), averaging less than one diameter apart (best visible on apical terga); sterna II–IV impunctate and glabrous apicomesally (Fig. 30c); mountains of northern and central California and adjacent regions of Nevada and Oregon *bohartorum* Pulawski, p. 51

– Terga less densely punctate and/or sterna punctate and setose from base to apex 67

67. Clypeal lip: distance between corners equal to 0.6–0.7 of clypeal length (Fig. 23, 25f); gaster all or partly red 68

– Clypeal lip: distance between corners about 0.9 of clypeal length in most specimens (Fig. 6d, 8e), but 0.8–1.0 in *aethiops* (in which gaster is all black in most specimens) 69

68. Sternal punctures finer than those on mesothoracic venter, extending from sternal base to apex; trochanteral venter of many specimens sparsely punctate *eldoradensis* Rohwer, p. 46

– Sternal punctures about as coarse as those on mesothoracic venter; sterna II–IV of most specimens with narrow, impunctate zone apicomesally; trochanteral punctures almost contiguous *hopi* sp. n., p. 47

69. Gaster all black to all red; midfemoral venter of many specimens sparsely punctate *aethiops* (Cresson), p. 26

– Gaster red basally; midfemoral venter densely punctate *montanus* (Cresson), p. 25

70. Axilla expanded laterally into lobe that overhangs lateral fossa (Fig. 48d, e); posterior corner of scutum prominent (Fig. 48b) *crassiformis* Viereck, p. 75

– Axilla not expanded, not overhanging lateral fossa; posterior corner of scutum rounded 71

71. Setae of sternum VII and VIII inclined to erect, up to 0.4 MOD long (Fig. 37); hypoepimeral setae appressed (see Fig. 34b); West Coast to 100th meridian *williamsi* R. Bohart, p. 62

– Sternal setae appressed; hypoepimeral setae appressed to erect 72

72. Mesopleuron and propodeum (including hindface) uniformly microareolate; hypoepimeral setae appressed; east of 100th meridian, north to North Carolina and Kansas *laevifrons* (F. Smith), p. 56

– Thoracic sculpture different, propodeal hindface ridged in most specimens (not ridged in *toltec*); hypoepimeral setae appressed (many *antennatus*) to erect 73

73. Mesopleuron angulate or weakly carinate between dorsal end of postspiracular carina and anterior end of subalar carina (Fig. 14b); basal half of sternum I with longitudinal, broad keel (Fig. 14c); east of 100th meridian *acutus* Patton, p. 34

– Mesopleuron not angulate or carinate between postspiracular carina and subalar carina; sternum I at most with longitudinal carina 74

74. Apical flagellomeres shorter, maximum length of flagellomere VIII about 1.1 × maximum width (Fig. 54c); forefemoral notch with conspicuous pruinosity (Fig. 54d, e); central Mexico *toltec* sp. n., p. 83

– Flagellomeres longer, maximum length of flagellomere VIII no less than 1.5 × maximum width; forefemoral notch glabrous or with usual, inconspicuous pruinosity 75

75. Mandibular inner margin roundly emarginate (see Fig. 50c, d); Cuba, Jamaica *cubanus* Pulawski, p. 77

– Mandibular inner margin not emarginate; continental North America 76

76. Setae of propodeal dorsum erect or nearly so in lateral view, about 1.0 MOD long; mesopleuron evenly microareolate (Fig. 19b) *semirufus* (Cresson), p. 40

– Setae of propodeal dorsum erect to markedly inclined anterad in lateral view, no longer than 0.7 MOD; mesopleuron evenly microareolate or differently sculptured 77

77. Mesopleuron with fine microsculpture (Fig. 21c), its punctures minute, about one to many diameters apart; gena thick in dorsal view (Fig. 21e) *pauxillus* W. Fox, p. 42

– Mesopleural microsculpture not conspicuous, punctures larger and/or denser, or mesopleuron impunctate, punctatorugose, or rugose; gena of most specimens thin 78

78. Setae of vertex and mesopleuron erect; forebasitarsus with one to three preapical rake spines that are as long as basitarsal width or longer; terga not fasciate; California and Nevada above 2,700 m *powelli* R. Bohart, p. 38

– Setae of vertex and mesopleuron markedly inclined; if vertex setae erect (*pinal*), then forebasitarsus without preapical rake spines; terga I–III of *pinal* fasciate apically 79

79. Vertex setae erect; clypeal lobe (Fig. 52b): distance between corners 1.5–1.6 × clypeal length
pinal sp. n., p. 81

– Vertex setae appressed or nearly so and/or clypeal lobe narrower 80

80. Gaster black; forebasitarsus with three or four preapical rake spines; propodeal side microridged or evenly microareolate; North Carolina to Florida and Alabama
krombeini Kurczewski, p. 70

– Gaster all or partly red; and/or forebasitarsus with none to two preapical rake spines; and/or propodeal side ridged 81

81. Clypeal lobe broader: distance between corners 1.5–1.6 × clypeal length (Fig. 46d); outer apical spine of foretarsomere II shorter than foretarsomere III
antennatus W. Fox, p. 72

– Clypeal lobe narrower (Fig. 4b): distance between lip corners 0.9–1.3 × clypeal length; if ratio is 1.2–1.4 (*miwok*) then outer, apical spine of foretarsomere II as long as foretarsomere III or longer 82

82. Outer apical spine of foretarsomere II as long as foretarsomere III or longer; clypeus (Fig. 43e): distance between lip corners more than distance between corner and orbit; California and adjacent areas of Nevada
miwok sp. n., p. 67

– Outer apical spine of foretarsomere II shorter than foretarsomere III; clypeus (Fig. 4b): distance between lip corners more to less than distance between corner and orbit 83

83. Gaster apically black, all black in some specimens
pompiliformis (Panzer), p. 20

– Gaster all red undescribed species, *orestes*, and/or red phase of *pompiliformis*?

DESCRIPTIONS OF THE SPECIES

pompiliformis Species Group

The *pompiliformis* group can be defined only by the absence of specializations found in other groups.

Propodeal dorsum and hindface forming obtuse angle; sternum I not carinate except in *acutus*; these two characters also found in *brevipennis*, *brullii*, *euxinus*, and *terminatus* groups (dorsum and hindface forming almost a right angle in *albocinctus*, *erythropus*, *isis*, *julliani*, and *schmiedeknechti* groups). Labrum of most species flat, not protruding beyond clypeal free margin or protruding only slightly, but convex and protruding beyond clypeal margin at least in *ashmeadii* and Palearctic *pusulosus* de Beaumont (labrum convex and protruding beyond clypeal margin in *geniculatus*, *panzeri*, and *undatus* groups). In the female, foretarsomere I not expanded (expanded in *albocinctus* group). In the male, forefemoral notch present except in *dominicanus* and some *psilocerus* (notch absent in *geniculatus* group, and in some species of other groups). Male sterna lack fimbriae and evenly setose in most species, but sterna II–VI largely glabrous mesally in *mirandus* (male sterna fimbriate in *erythropus* and *euxinus* groups, and all or largely glabrous in *albocinctus*, *isis*, *julliani*, and *schmiedeknechti* groups). Prey consists mainly of nymphal acridids, but *fulvitarsis* A. Costa (Palearctic), *semirufus*, and *tipai* provision nests with nyphal tettigoniids. Members of *pompiliformis* group occur in all zoogeographic regions, but in South America only in the Andes.

SYSTEMATICS.—The laterally oriented midscutal setae combined with the apically depressed sternum I and a punctate mesopleuron are shared by *arizonac*, *huchiti*, *lamellatus*, *sonorensis*, *texanus*, *tsil*, *yolo*, and *yuma*; also *amplus* is similar in spite of its unique sternum I. At least the setal pattern and the shape of sternum I are derived characters, indicating that the species listed above are a closely related lineage within the *pompiliformis* group.

Tachysphex papago is closely related to *psilocerus* and *scopaeus*, as evidenced by two synapotypies: presence of a malar space and peculiar tergal sculpture.

Tachysphex pompiliformis (Panzer)

(Figures 4–5)

Larra pompiliformis Panzer, 1805 Heft 89, plate 13, ♀. ! Holotype: ♀, Germany: no specific locality (Zool. Samml. Bayer. Staates, Munich, Germany).—In *Tachytes*: Shuckard 1837:252.—In *Tachysphex*: Kohl 1885:388 (as synonym of *Tachysphex pectinipes* of Kohl); Richards 1935:163, Pulawski 1971:62 (descr.).

Tachytes nigripennis Spinola, 1808:260, ♀. Holotype or syntypes: ♀, Italy: "prope Genuam" (?lost).—In *Tachysphex*: Kohl 1885:389. Synonymized with *pompiliformis* by Pulawski 1971:62.

Larra dimidiata Panzer, 1809 pl. 13, ♀. Holotype or syntypes: ♀, Germany: no specific locality (Zool. Samml. Bayer. Staates, Munich, Germany). Synonymized with *pectinipes* of Kohl by Kohl 1885:388. ! Holotype: ♀, Germany: no specific locality (Zool. Samml. Bayer. Staates, Munich, Germany). Synonymized with *pectinipes* of Kohl by Kohl 1885:388.

As *Sphex pectinipes* Linnaeus, 1758 (which actually is a pompilid).—In *Larra*: Dahlbom 1832:53.—In *Tachytes*: Dahlbom 1849:249.—In *Tachysphex*: Kohl 1885:388, de Beaumont 1936:202.

Larrada parvula Cresson, 1865:465, ♂. ! Lectotype: ♂, Colorado, no specific locality (ANSP), designated by Cresson 1916:96. **New synonym.**—As synonym of *Larra montana*: Patton 1880:389, Kohl 1885:246.—In *Tachysphex*: W. Fox 1894*a*:518, Dalla Torre 1897:683, Ashmead 1899:250, Rohwer 1908:223, G. Bohart 1951:951, Krombein 1967:393, Alcock 1973:329, Bohart and Menke 1976:275, Krombein 1979:1929.

Larra Quebecensis Provancher, 1882:50, ♀, ♂, incorrect original spelling. ! Lectotype: ♀, Canada: Quebec: no specific locality (Laval Univ., Quebec), **present designation. New synonym.**—Provancher 1883:633 (as sp. n.); Peckham and Peckham 1905:263, Bridwell 1899:208.—In *Tachysphex*: W. Fox 1894*a*:257; Dalla Torre 1897:685, Ashmead 1899:250, J. Smith 1900:518, Harrington 1902:221, J. Smith 1910:683, Williams 1914:173, Rohwer 1916:687, Gahan and Rohwer 1917:433, G. Bohart 1951:952, Krombein 1967:393, Elliott and Kurczewski 1973:80, Steiner 1973:24, Bohart and Menke 1976:276; Krombein 1979:1629, Finnamore 1982:103.

Larra abdominalis Provancher 1887:266.

Tachysphex austriacus Kohl, 1892:215, ♀. ! Holotype: ♀, Austria: Vienna area (Naturhist. Mus. Vienna, Austria). Synonymized with *pompiliformis* by Pulawski 1971:62.

Tachysphex decorus W. Fox, 1894*a*:524, ♀. ! Holotype: ♀, Dakota: no specific locality (ANSP). **New synonym.**—Dalla Torre 1897:679, Ashmead 1899:250, Cresson 1928:44, G. Bohart 1951:951, Bohart and Menke 1976:275, Krombein 1979:1628.

Tachysphex tenuipunctus W. Fox, 1894*a*:525, ♀. ! Lectotype: ♀, Oregon: Mt. Hood (ANSP), designated by Cresson 1928:46. **New synonym.**—Dalla Torre 1897:686, J. Smith 1910:683, Stevens 1917:422, Mickel 1918:423, Strickland 1947:129, G. Bohart 1951:953, Newton 1956:615, Ferguson 1962:81, Krombein 1967:393, Bohart and Menke 1976:277, Krombein 1979:1630.

Tachysphex consimilis W. Fox, 1894*a*:526, ♀, ♂. ! Lectotype: ♀, Montana: no specific locality (ANSP), designated by Cresson 1928:44. Synonymized with *parvulus* by R. Bohart *in* Bohart and Menke 1976:275.—Dalla Torre 1897:678, Ashmead 1899:250, H. Smith 1908:382, Williams 1914:164 (as *consimilis* Cresson); Mickel 1918:423, G. Bohart 1951:950.

Tachysphex rufo-niger Bingham, 1897:195, ♀ (incorrect original spelling). ! Lectotype: ♀, "North-West Provinces" [of India or Pakistan?]: no specific locality (BMNH), designated by Pulawski 1975:310. Synonymized by Pulawski 1975:310.

Tachysphex projectus Nurse, 1903:517, ♀. ! Holotype: ♀, Kashmir: no specific locality (BMNH). Synonymized by Pulawski 1975:310.

Tachysphex argyrotrichus Rohwer, 1911:572, ♂. ! Holotype: ♂, Colorado: Las Animas Co.: Trinidad (USNM). Synonymized with *parvulus* by R. Bohart *in* Bohart and Menke 1976:275.—G. Bohart 1951:950.

Tachysphex granulosus Mickel, 1916:413, ♀. ! Holotype: ♀, Nebraska: Sioux Co.: Glen (UNL). Synonymized with *tenuipunctus* by G. Bohart 1951:953.—Mickel 1918:422; Strickland 1947:129.

Tachysphex erythraeus Mickel, 1916:415, ♀. ! Holotype: ♀, Nebraska: Warbonnet Canyon (UNL). **New synonym.**—Mickel 1918:424, G. Bohart 1951:951; Bohart and Menke 1976:273, Krombein 1979:1628.

Tachysphex angularis Mickel, 1916:416, ♂. ! Holotype: ♂, Nebraska: Sioux Co.: Sowbelly Canyon (UNL). **New synonym.**—Mickel 1918:424, G. Bohart 1951:950; Bohart and Menke 1976:272, Krombein 1979:1627.

Tachysphex unidentified species: Steiner 1981:333.

Diagnosis.—*Tachysphex pompiliformis* is a widespread, common species, but it is difficult to characterize because of considerable variability and lack of a single prominent diagnostic feature. It can be recognized primarily by the microsculptured mesopleuron with shallow, inconspicuous punctures and erect or suberect setae; the finely, densely punctate mesothoracic and trochanteral venter and forefemur; and weak or absent fascia on gastral tergum I. The gaster is bicolored (red basally, black apically) or (some specimens) all black. In the female, the clypeal lip is arcuate, with a lateral incision on each side, and the vertex is wider than long. In the male, the distance between clypeal lobe corners is about equal to the distance between a corner and the orbit, and the foretarsal rake is absent.

Tachysphex pompiliformis is similar to *montanus* and *powelli* (see these species).

Description.—Punctures shallow, subcontiguous on frons; less than one diameter apart on vertex and scutum (but some punctures slightly more than one diameter apart). Mesopleuron dull, microreticulate, with shallow, minute, inconspicuous punctures; hypoepimeral area of some specimens weakly rugose. Propodeal dorsum and side mostly microreticulate, but ridged or rugose in some specimens (especially large ones), and intermediate occur; hindface ridged, but ridges evanescent in small individuals. Sternum I without apical depression. Hindcoxa not carinate.

Setae appressed on scutum and midfemoral venter.

Head, thorax, and legs black, tarsal apex brown or reddish. Gaster all black in some individuals, but two or three basal segments red in most specimens. Tergal fasciae varying. Wings infumate, but only weakly so in the smallest males.

♀.—Clypeus (Fig. 4a): bevel shorter to longer than basomedian area; lip arcuate, without mesal notch, incised laterally. Dorsal length of flagellomere I 1.8–2.3× apical width. Vertex wider than long. Discal micropuntures of tergum II two to several diameters apart. Tergum V densely punctate, but apical depression often impunctate. Pygidial plate alutaceous, sparsely punctate. Trochanteral and femoral punctures fine, dense. Length 7–11 mm.

Frontal vestiture not totally obscuring integument between antennal socket and orbit (except in occasional individuals). Vertex setae subappressed to suberect, about 0.7 MOD long.

Frontal vestiture silvery or with golden tinge.

♂.—Mandibular inner margin with tooth (Fig. 4b). Clypeus (Fig. 4b, c): bevel as long as basomedian area or much shorter; lip arcuate or sinuate, distance between corners equal to 0.9–1.3 of clypeal length and also of distance between corner and orbit. Dorsal length of flagellomere I 1.2–1.6× apical width. Vertex width 1.4–1.7× length. Sterna densely punctate and pubescent throughout. Forefemoral notch glabrous. Foretarsus in most specimens without rake; outer apical spine of tarsomere II shorter than foretarsomere III. Length 5–8 mm.

Integument totally obscured by vestiture between antennal socket and orbit as seen from certain angles. Vertex setae subappressed to erect, 1.0 MOD long. Frontal vestiture silvery to brassy golden.

Variation.—Northern specimens (Yukon Territory, Northwest Territories) average larger than southern individuals.

In most females the integument is not totally obscured by vestiture between orbit and antennal socket, but it is totally hidden in three females from Stockton, Manitoba (CNC).

In most females terga I–III are silvery fasciate apically (fascia of tergum I inconspicuous), but tergum IV is also fasciate in two females from Saskatchewan: Attons Lake and Saskatoon (CNC). Only tergum II is fasciate or all fasciae are evanescent in many females from Alberta, British Columbia, Washington, Oregon, and California.

Most males have pale golden frontal vestiture, and nonfasciate tergum IV, but in most males from eastern Canada (Nova Scotia, Prince Edward Island, Quebec), the frontal vestiture is silvery or with golden tinge, and terga I–IV are fasciate apically. In many males from western Canada (Alberta, British Columbia), the frontal vestiture is brassy golden, and apical fasciae are present on terga I–III (fascia of tergum I evanescent in most specimens).

The forebasitarsus of most males has only the apical spine on outer margin, but a preapical spine is present in a male from Stockton, Manitoba (CNC) and a male from Elbow, Saskatchewan (CNC); two short, preapical spines are present in one of the six males examined from Bear Creek, Idaho (UIM).

The lip corners of the male clypeus are closer to the orbits than to one another in most specimens, but they are equidistant in some individuals from Alberta and slightly closer to each other than to orbits in a male from Squamish, British Columbia (CNC).

The first two or three gastral segments are red in most specimens, but only tergum II is red in some individuals. Also segment IV is red in a female from Buckeye Reservoir, Colorado (CSU). Occasionally the gaster is all black, especially in specimens from higher altitudes and latitudes, or has a reddish preapical shadow on terga I and II.

Discussion.—*Tachysphex pompiliformis* is a Holarctic species, a fact unrecognized in both the Palearctic and Nearctic regions. Nearctic populations have been treated under several names (see synonymy), of which *parvulus* and *tenuipunctus* were the most commonly used. There are slight differences between Old and New World *pompiliformis*. The propodeal side is ridged in most Palearctic specimens, but evenly microsculptured in some, e.g., from Leningrad area, as it is in most North American specimens.

Tachysphex pompiliformis is difficult to define, and several undetermined phena may actually belong to this species. Another possibility is that I have assigned a cluster of similar, unrecognized species to *pompiliformis*. In particular, I do not know whether *pompiliformis* may have an all red gaster (many such specimens look like *pompiliformis*, but possibly they are another species).

Note on *Tachysphex quebecensis*.—Provancher called this

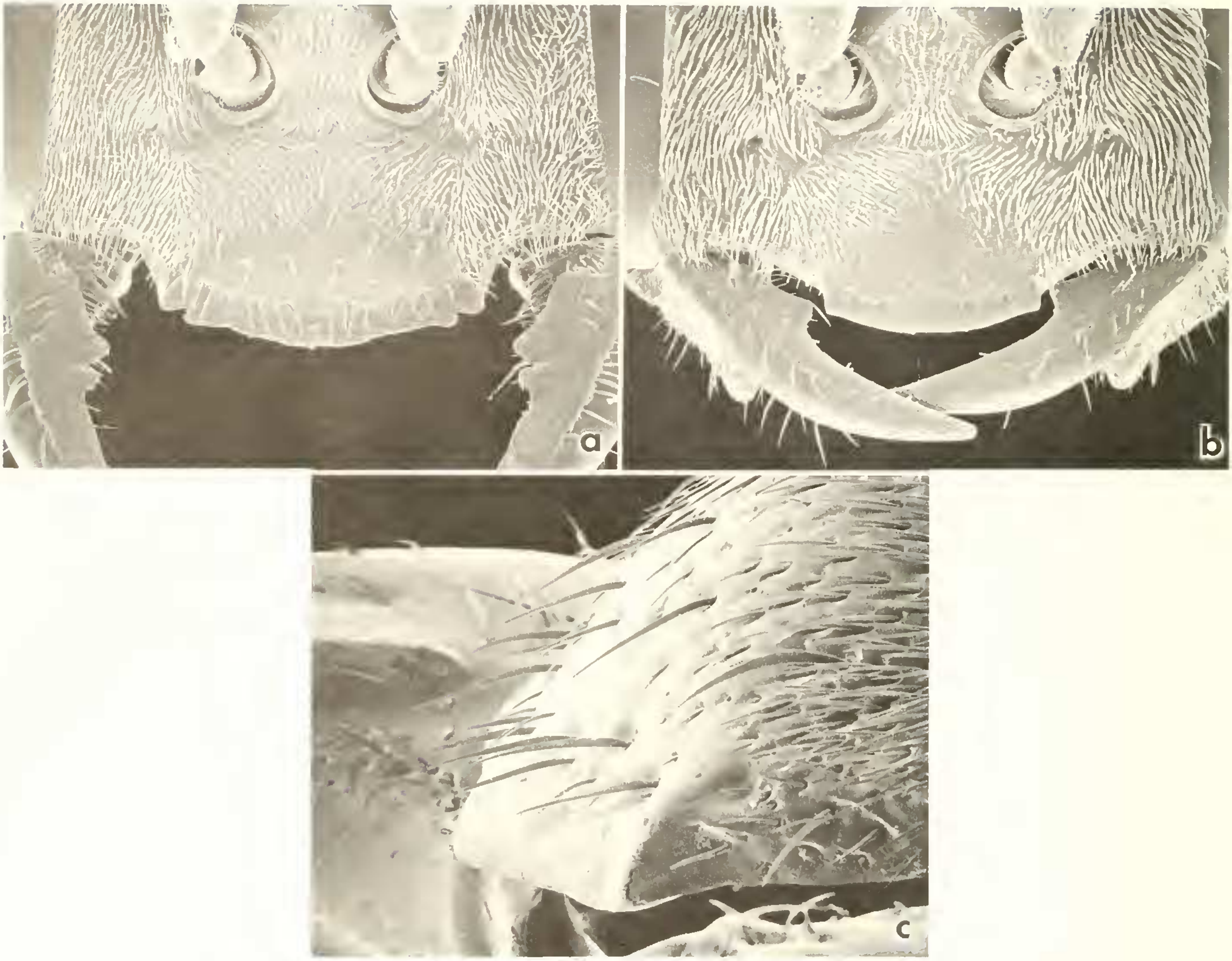

FIGURE 4. *Tachysphex pompiliformis* (Panzer): a—female clypeus; b—male clypeus; c—male clypeus obliquely from the side.

species *Larra quebecensis* in 1882 and 1883, but referred to it as *Larra abdominalis* in 1887. Gahan and Rohwer (1917–18) were unable to locate the syntypes of the former name in Provancher's collection, but individuals labeled as *Larra abdominalis* are present there. I have accepted these as the type material of *quebecensis*.

The type of *quebecensis* and several other specimens examined have the propodeal dorsum and side ridged and rugose. In most *pompiliformis* these parts are uniformly microareolate, but the two extremes are connected by a range of intermediates; e.g., the dorsum is microrugose or irregularly ridged basally, and the side is microreticulate or finely ridged. The complete range of intermediates from ridged to nonridged propodeum can be found within a single population, e.g., in specimens from Alger County, Michigan (UMMZ), or Huron Mountain Club, Michigan (CAS, UMMZ).

LIFE HISTORY.—Observations of European writers were summarized by Pulawski (1971). In Europe, *pompiliformis* nests in flat or sloping areas, sometimes in cliffs. Nest construction precedes provisioning. There are one to three cells per nest, but one is usual. The nest entrance is permanently open during the provisioning period. The prey consists of acridid nymphs, which are flown to the nest or transported on the ground. During transport the wasp straddles the acridid, which is oriented dorsum up and held by the antennae with the wasp's mandibles. One to ten prey are deposited in a cell, depending on their size. The egg is laid on the largest prey at the end of the provisioning.

In North America the life history of *pompiliformis* was observed by Peckham and Peckham (1905, as *quebecensis*) in Wisconsin, by Newton (1956, as *tenuipunctus*) near Shoshone, Idaho, and by Alcock (1973, as *parvulus*) near Seattle, Washington. These observations are incomplete, but they agree with European reports. All nests were in flat areas; they were unicellular and open during the provisioning period. The nests examined by Alcock (1973) were oblique to the surface (5.5 cm long, ending 2.5–3.5 cm below the soil surface). Prey carriage is the same as in European specimens, although Peckham and Peckham (1905) state that the wasp holds the prey "in her third legs." The Peckhams observed that the wasp deposits prey at the nest entrance first and then drags it backwards inside the nest. At Shoshone two small prey per cell were deposited in early June, but only one large prey in late June; the nest observed by the Peckhams was provisioned with three prey. Most prey collected near Shoshone were *Oedaleonotus enigma* (Scudder), but a few *Aulocara elliotti* (Thomas) and one *Melanoplus* sp. were also observed. Krombein (1967, as *quebecensis*) lists immature Acrididae (*Camnula, Melanoplus*). A female examined from Dickinson, North Dakota (USNM) is pinned with her prey, a nymph of *Melanoplus* sp., and a female from Mt. Rose, Nevada (UCD) with an acridid nymph, probably *Aulocara* (det. D. C. F. Rentz). The sarcophagid fly *Taxigramma heteroneura* (Meigen) is a parasite. Another parasite, the mutillid *Sphaerophthalma orestes* (Fox), was reported by Ferguson (1962) from Merrill, Oregon. Flower records: males from Cottonwood, Idaho, were collected on *Eriogonum*, and males from Sand Dune Lake, Idaho, on *Helianthus* (UIM). There is one generation per year at Shoshone.

Steiner (1981) found that the prey of this species is paralyzed with four consecutive stings and described the stinging sites on the prey's body.

GEOGRAPHIC DISTRIBUTION (Fig. 5).—*Tachysphex pompiliformis* is now known to be Holarctic. In North America it is transcontinental but largely northern. It ranges north to Prince Edward Island and the delta of the Mackenzie River, south to New York and Michigan. In the west, it occurs in mountains of Colorado and the Sierra Nevada in California.

In the Old World the species is widespread. It occurs from the eastern coast of Ireland to Kamchatka. It ranges northward to Scotland (except Highlands), to the polar circle in Finland (Rovaniemi), and to Yakutsk in Siberia. Its southern limits include the northern Mediterranean countries, Morocco, Turkey, northern Iran (Elburz Mountains, Meshed), Kashmir, and Ulan Baator in Mongolia. *Tachysphex pompiliformis* is apparently absent from the Transcaspian deserts.

MATERIAL EXAMINED.—1,043♀, 919♂.

RECORDS.—CANADA. **Alberta:** Banff, Beaver Lodge, Beverly, Brooks, Cowley, Drumheller, Elkwater Park, Empress, Frank, Jumping Pd. Creek (20 mi W Calgary), Laggan (=Lake Louise), Lethbridge, McMurray, Medicine Hat (also 25 mi NW), 15 mi E Morley, 12 km SW Orion, Raymond, Red Deer, Scandia, Taber, Turin, Wainwright, Waterton Park, Writing-on-Stone Provincial Park. **British Columbia:** Agassiz, Carbonate Columbia River, Chapmans (Frazer River), Galiano, Hatzic Lake, Kaslo, 20 mi S Lytton (Frazer River), Merritt, Minnie Lake, Mission City, North Thormanby Island, Okanagan, Orofino Mt. near Oliver, Racing River, Revelle Lake, Robson, Squamish, Taylor, Yale Region (4 mi W Princeton). **Manitoba:** Aweme, Bird's Hill Province Park (15 mi N Winnipeg), Boisevain, 6 mi NW Brandon, Churchill, Emerson, Falcon Lake (15 mi E Rennie), Horton, Melita, mile 503 Hudson Bay Highway, 30 mi N Roblin, 5 mi SW Shilo, Spruce Woods Province Park (8 mi N Glenboro), Stockton, Whitewater. **New Brunswick:** Nerepis, Peticodiac. **Northwest Territories:** Aklavik, Fort Providence, Mackenzie Delta, Normal Wells, Rae, Yellowknife. **Nova Scotia:** Baddeck, Cape Breton Island, Hants Cove, Kentville, Lockeport, Sable Island, Truro. **Ontario:** Gravenhurst (Muskoka District), Kearney, Longbow Corners (11 mi E Kenora). **Prince Edward Island:** Brackley Beach, Dalvay House in Prince Edward Island National Park. **Quebec:** Burbidge, Kazabazua, Mont Joli, Old Chelsea, Sainte Anne de la Pocatière, Sully. **Saskatchewan:** Attons Lake W Cut Knife, Big River, Christopher Lake, Elbow, Good Spirit Lake, Moose Jaw, Parkbeg, Pike Lake, Prince Albert, Rutland, Saskatoon, 5 mi E Swift Current, Willoe Bunch. **Yukon Territory:** Minto Landing Territorial Campground (Klondike Loop J-148), Watson Lake, Whitehorse.

UNITED STATES: ALASKA. Matanuska. ARIZONA. **Apache:** Alpine, Greer, McNary. **Cochise:** Ramsey Canyon in Huachuca Mts. **Coconino. Graham:** Hospital Flat (Pinaleno Mts.), Mt. Graham. **Greenlee:** Hannagan Meadows. **Mohave:** Grand Canyon (North Rim). CALIFORNIA. **Alpine:** Carson Pass, Hope Valley, Winnemucca Lake. **Amador:** 4 mi N Silver Lake. **Contra Costa:** Las Trampas Ridge W Danville. **Del Norte:** Beans Camp, Crescent City. **El Dorado. Fresno. Humboldt:** Big Lagoon, Patricks Pt., Red Cap Lake. **Inyo. Lassen:** Bridge Creek Camp. **Madera:** Green Mtn. (S Mariposa on county line). **Marin:** McClure's Beach, Point Reyes, Tomales. **Mariposa:** Yosemite National Park (Crane Flat, Glacier Point, Tenaya Lake). **Mendocino:** 4 mi E Point Arena, Mendocino, Navarro River 3 mi SE Paul M. Dimmick State Park. **Modoc. Mono. Monterey:** Paraiso Springs. **Nevada:** Boca, Sagehen Creek near Hobart Mills, 7 mi SE Truckee. **Placer:** Carnelian Bay on Lake Tahoe, Tahoe. **Plumas. San Bernardino:** San Bernardino Mts. **San Francisco:** San Francisco. **San Mateo:** San Bruno Mts. **Santa Cruz:** Big Basin. **Shasta:** 4 mi S Burney, Lassen Peak, Summit Lake. **Sierra. Siskiyou. Sonoma:** —. **Stanislaus:** Evergreen Road 3.2 mi W Highway 120. **Trinity:** Big Flat (Coffee Creek), Carrville, Scott Mt. **Tulare. Tuolumne. Yolo:** Rumsey. COLORADO: **Alamosa:** Mosca. **Boulder. Chaffee:** Buena Vista, 7,800 ft. **Clear Creek. Costilla:** Russel, Ute Creek. **Custer:** Alvarado Creek (Sangre de Cristo Mts.), Westcliffe. **Delta:** Grand Mesa. **Denver:** Denver. **Douglas:** 20 mi S Denver, Longview. **Eagle:** Tennessee Pass. **El Paso. Gilpin:** Pinecliffe. **Grand:** Granby, Troublesome. **Gunnison:** Lead King Basin. **Jackson. La Plata:** Bayfield. **Larimer. Mesa:** 31 mi N Mack, Pinon Mesa. **Montrose:** Buckeye Reservoir. **Park:** Grant, Jefferson, Wilkerson Pass. **Pitkin:** Ajax Mt. near Aspen. **Rio Grande:** South Fork. **Routt. Teller:** Florissant. **Weld:** 1 mi NE Nunn. IDAHO: **Bear Lake:** 9 mi E Montpellier, 5 mi W Ovid. **Blaine. Boise:** 3 mi NE Garden Valley. **Bonner:** Blanchard. **Boundary:** 2 mi S Naples. **Butte:** Bear Creek Pass, Craters of the Moon National Monument. **Cassia:** Emery Canyon (12 mi SE Oakley). **Clark:** 13 mi NE Kilgore. **Clearwater:** Elk River. **Custer. Franklin:** Cub River Canyon, 8 mi E Mink Creek. **Fremont:** 10 mi NE Ashton, Bootjack Ferry, Box Canyon (Island Peak). **Gem:** Emmett. **Idaho:** 6 mi SE Grangeville, Lolo Pass Shotgun Creek, Warren. **Kootenai:** Lane. **Latah:** Moscow (also 7 mi N, Moscow Mtn. **Lemhi:** 2 mi N Gilmore, Lemhi Pass. **Lincoln:** Dietrich Butte, Shoshone. **Oneida:** Black Pine Canyon, Salyer Cow Camp. **Owyhee:** Walter's Ferry, Sand Dune Lake. **Shoshone:** 4 mi N Avery (also 7 and 10 mi E, 8 mi N), Red Ives Research Station (also 5 mi NW). **Valley:** Darling's Flat (S Fork Salmon River), Lake Fork, 4 mi W McCall. MAINE. **Cumberland:** Portland. **Hancock:** Hancock. **Lincoln:** Waldoboro. **Penobscot:** Orono. **Sagadahoe:** Brunswick. MASSACHUSETTS. **Middlesex:** Reading. MICHIGAN: **Alger:** Pictured Rocks National Lakeshore. **Baraga:** Pequaming. **Benzie:** —. **Charlevoix:** Thumb Lake. **Colfax, Emmet, Gladwin, Grand Traverse, Iosco:** —. **Iron:** Crystal Falls. **Kalkaska, Keweanaw:** —. **Marquette:** Huron Mountain Club, Marquette, Yellow Dog Plains. **Midland:** —. **Muskegon:** Muskegon State Park. **Osceola:** Tustin. **Schoolcraft:** Floodwood. MINNESOTA. **Blue Earth:** Mankato. **Itasca:** Itasca Park. **St. Louis:** Duluth. MONTANA. **Beaverhead:** 3 mi W Jackson. **Dawson:** Glendive. **Gallatin:** Three Forks. **Hill:** Simpson. **Madison:** 16 mi S Cameron, 9 mi N Ennis, Louise Lake. **Meagher:** White Sulphur Springs. **Missoula:** 3 mi S Arlee. **Park:** Gardiner. **Ravalli:** Hamilton, Sula. NEBRASKA. **Douglas:** Omaha. **Hooker:** Dismal River 15 mi S Mullen, 1.5 mi N Mullen. **Sheridan:** Bingham. **Sioux:** Monroe Canyon, Sowbelly Canyon. NEVADA. **Elko. Humboldt:** Winnemucca. **Lander:** 40 mi N Austin, Kingston Recreation Area (Toiyabe Mts.). **Lincoln:** Hiko Range. **Nye:** 10 mi N Gabbs. **Washoe:** Mt. Rose, Steamboat. **White Pine.** NEW HAMPSHIRE. **Coos:** Crawford's. **Grafton:** Franconia, White Mts. NEW MEXICO: **Colfax:** 5 mi S Eagles Nest, Raton, 2 mi W Ute Park. **Otero:** Cloudcroft, Weed. **Sandoval:** Jemez Springs. **San Miguel:** Beulah, Pecos. **Santa Fe:** Little Tesuque Canyon near Santa Fe. **Taos:** Taos. NEW YORK. **Franklin:** —. **Madison:** Chittenango. **Oswego:** Oswego. **Saint Lawrence:** Parishville. **Tompkins:** Freeville, McLean. NORTH DAKOTA. **Bottineau:** Bottineau. **Bowman:** Gascoyne. **Grand Forks:** Northwood. **Hettinger:** Mott. **McHenry:** Towner. **McLean:** Washburn. **Ramsey:** Devils Lake. **Richland:** 12 mi W Walcott. **Stark:** Dickinson. OREGON. **Baker:** Cornucopia. **Benton:** Corvallis, 5 mi W Lewisburg. **Clackamas:** Mt. Hood. **Curry:** Winchuck River (mouth). **Deschutes:** Deschutes River 1 mi SW Pringle Falls. **Harney:** Blitzen River headwaters (Steens Mts.), 4 mi NE Flagstaff Butte. **Hood River:** Mt. Hood. **Klamath. Lane:** Horse Lake (High Cascade Mts.), 10 mi E Oakridge. **Lincoln:** Newport, Yaquima Bay. **Marion:** Silver Creek Peak. **Polk:** Black Rock (10 mi SW Dallas). **Wallowa:** Wallowa Lake. **Washington:** Cornelius, Forest Grove. SOUTH DAKOTA. **Brown:** Hecla. **Custer:** Custer. **Pennington:** Badlands National Park. UTAH. **Box Elder. Cache. Carbon:** Price Canyon Recreation Area (1 mi W Castle Gate). **Daggett:** Ridge Camp (30 mi N Vernal). **Davis:** Bountiful Peak. **Duchesne:** Roosvelt. **Emery:** Huntington Creek, Orange Olsen Ranger Station. **Garfield:** 15–16 mi N Boulder, Boulder Mtn. **Grand:** LaSal Mts., 12 mi N Moab. **Iron:** Cedar Breaks, Deer Valley, Miner's Peak. **Juab:** Mt. Nebo. **Kane:** Duck Creek Camp, Navajo Lake. **Millard:** Oak Creek Canyon (Oak City). **Rich:** Bear Lake, Logan Canyon summit, Monte Cristo. **Salt Lake:** Midvale, Mill Creek Canyon, Salt Lake City. **Sanpete:** Ephraim, Moroni. **Uintah. Utah:** Lehi, Provo. **Wasatch:** Guardsman Pass near Brighton, Park City. **Washington:** St. George, Upper Deep Creek. **Weber:** Beaver Creek (head), Ogden, Willard Peak. VERMONT. **Rutland:** Chittenden. **Windham:** Jamaica. WASHINGTON. **Clark:** Vancouver. **King:** Seattle. **Kittitas:** Fish Lake. **Klickitat:** Brooks State Park. **Pacific:**

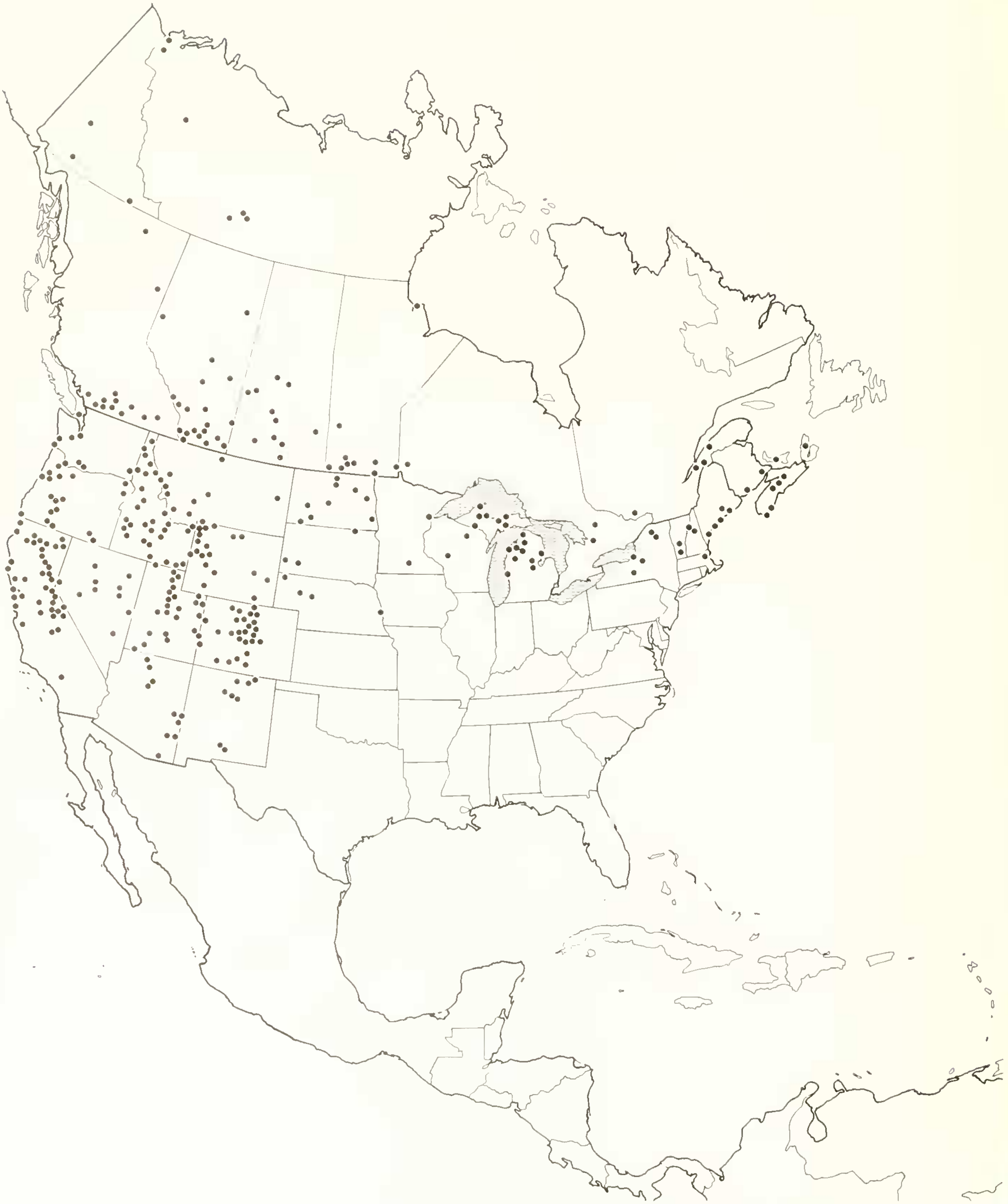

FIGURE 5. Geographic distribution of *Tachysphex pompiliformis* (Panzer) in North America

Bay Center, Long Beach, Nahcotta, Seaview. **Pend Oreille:** Metaline Falls. **San Juan:** Argyle (San Juan Island), Friday Harbor, Lopez Island. **Thurston:** Olympia. **Walla Walla:** Mill Creek. **Whitman:** Lyle Grove near Pullman, Pullman (Smooth Hill). **Yakima:** Mt. Adams. WISCONSIN: **Clark:** Worden Township. **Oneida:** Woodruff. WYOMING: **Albany:** 10 mi SE Laramie (also 13 mi NE), Summit. **Big Horn:** 10 mi E Shell. **Converse:** Glenrock. **Fremont:** Brooks Lake (Shoshone National Forest), Sweetwater River at Highway 28, Union Pass Road. **Lincoln:** 2 mi S Alpine, Dietrich Butte. **Park:** Lake Creek Camp (13 mi SE Cooke City, Montana). **Platte:** Glendo. **Sheridan:** Bighorn, Long Park (20 mi SW Big Horn). **Sublette:** Green River Lakes, 3 mi N Pinedale. **Sweetwater:** Green River. **Teton** (excluding Grand Teton and Yellowstone National Parks). **Teton** (Grand Teton National Park). **Yellowstone National Park.**

Tachysphex montanus (Cresson)

(Figures 6, 7)

Larrada montana Cresson, 1865:465, ♀. ! Lectotype: ♀, Colorado: no specific locality (ANSP), designated by Cresson 1916:96.—Cresson 1876:208.—In *Larra*. Patton 1881:389; Ashmead 1890:33.—In *Tachysphex*. W. Fox 1894*a*:523; Dalla Torre 1897:681, Ashmead 1899:250, G. Bohart 1951:951, Krombein 1967:393, Bohart and Menke 1976:275, Krombein 1979:1628.

Tachysphex musitatus W. Fox, 1894*a*:524, ♂. ! Holotype: ♂, Colorado: no specific locality (ANSP). Synonymized by G. Bohart 1951:951.—Dalla Torre 1897:680; Ashmead 1899:250, Cresson 1928:45.

Tachysphex compactus W. Fox, 1894*a*:528, ♂. ! Holotype: ♂, British Columbia: Vancouver (ANSP). Synonymized by G. Bohart 1951:951.—Dalla Torre 1897:678, Ashmead 1899:250; Harrington 1902:221, Cresson 1928:44

Tachysphex triquetrus W. Fox, 1894*a*:528, ♀. ! Holotype: ♀, Nevada: no specific locality (ANSP). Synonymized by Pulawski *in* Krombein 1979:1628.—Dalla Torre 1897:686; Ashmead 1899:250 (as *triquitrus*); Cresson 1928:46; G. Bohart 1951:953; Bohart and Menke 1976:277.

DIAGNOSIS.—The female of *montanus* can be recognized by the sculpture of the forefemur: the fine punctures (which are dense or sparse basoventrally) are superimposed basoventrally with large, sparse, punctures (Fig. 6b, c). In other species, the forefemoral venter is evenly micropunctate (large punctures absent or inconspicuous), or (*aethiops*) only large punctures are present, or (*mirandus, tipai*) all punctures are fine, sparse. The forefemoral punctation is similar in *montanus*, many *powelli*, and some *pompiliformis*, but unlike the latter two species, the females of *montanus* and *aethiops* have an unusually deep subalar fossa (the anterior half of its bottom intersects the posterior half at about a right angle). In addition, the gaster of *montanus* is red (at least basally), but is all black in most *powelli*.

The male of *montanus* is very similar to *aethiops*. See that species for differences.

DESCRIPTION.—Frontal punctures nearly contiguous. Vertex punctures subcontiguous to about one diameter apart. Mesopleuron microsculptured, with shallow, inconspicuous punctures. Propodeal dorsum evenly microareolate, also slightly ridged basally in some specimens; side microsculptured or weakly ridged; hindface ridged or ridges evanescent above. Sternum I without apical depression. Discal micropunctures of tergum II one to two diameters apart. Hindcoxa not carinate.

Vestiture not obscuring integument between antennal socket and orbit. Setae suberect, shorter than MOD on vertex and scutum, but erect, 1.0 MOD long on postocellar impression, appressed on femora.

Head, thorax, and legs black, tarsal apex reddish. Gastral segments I–III red, the remainder black or red. Terga not fasciate. Wings weakly infumate. Frontal vestiture silvery in most specimens, but golden in males from Dry Lake Mountain, California.

♀.—Clypeus (Fig. 6a): bevel equal to basomedian area or longer, in most specimens concave anteriorly (shallowly to deeply); lip arcuate, broadly incised laterally, in most specimens weakly emarginate mesally. Dorsal length of flagellomere I 2.3–2.7 × apical width. Vertex wider than long. Scutal punctures fine, on disk averaging one to two diameters apart. Subalar fossa deep, the anterior half of its bottom intersecting the posterior half at about a right angle. Tergum V densely punctate (sometimes sparsely mesally), its apical depression impunctate. Pygidial plate shiny, punctate. Forefemur finely, densely punctate, and also with large, sparse, conspicuous punctures (Fig. 6b, c); see Variation below for details. Length 11–14 mm.

♂.—Mandibular inner margin with tooth (Fig. 6d). Clypeus (Fig. 6d): bevel about as long as basomedian area or shorter; lip arcuate, its corners rectangular, separated by a distance that equals 0.6–0.8 of distance between a corner and orbit and about 0.8–1.0 of clypeal length; sharp carina emerges from lip corners and extends slightly beyond lip base. Dorsal length of flagellomere I 1.6–1.8 × apical width. Vertex width about 1.7 × length. Sterna densely punctate. Forefemoral notch glabrous. Forebasitarsus with none to two preapical spines; outer apical spine of foretarsomere II shorter than foretarsomere III. Length 8.5–10.0 mm.

VARIATION.—*Mesopleural setae.* Nearly appressed in most specimens, but nearly erect in individuals from southern California (13 mi E Amboy, Borrego Valley, Glamis, 20 mi E Glamis, Needles), and also in some specimens from Idaho: Lincoln Butte (1♂, UCD), Oakley area (2♂, UIM), Parowan Canyon, Utah (1♂, UCD), and Sunnyside area (1♂, UIM). There is some intergradation in this character.

Trochanteral punctures (female). The trochanteral venter is closely punctate in many specimens, but sparsely punctate in the females in which the forefemoral micropunctures are sparse basoventrally. In addition, the trochanteral venter is sparsely punctate in some females in which the forefemoral micropunctures are uniformly dense, e.g., in individuals from Borrego Valley (1♀, UCD) and Glamis (1♀, UCD).

Forefemoral punctures (female). Micropunctures are uniformly dense in most females, but sparse basoventrally (several to many diameters apart) in some. Full intergradation from one state to another may be observed within the same population (e.g., 6 mi N Cedarville, California). Females with sparse forefemoral micropunctures have been observed in the following localities: California: 6 mi N Cedarville (1♀, UCD), Sagehen Creek (1♀, CAS; 2♀, UCD), Tahoe (1♀, UCD); Oregon: Cornucopia (2♀, CAS, UCD).

Midfemoral punctures. In most individuals, the punctures of midfemoral venter are no more than one diameter apart, but up to several diameters apart in some females from Rainbow Valley, Arizona, and in some males from southern California. Intergradation in this character was observed in the females from Rainbow Valley, and punctation varies from dense to sparse in males collected 18 mi W of Blythe, California.

DISCUSSION.—*Tachysphex montanus* is not easily defined, and many females closely resemble *pompiliformis*, while males are similar to *aethiops*. Furthermore, *montanus* occurs in diverse habitats: from alpine zone (White Mts., California) to lowland sand dunes (Borrego Valley and Glamis, California). In spite of the difficulties of defining it, I regard *montanus* as a good species. The sex association is beyond doubt: both males and females

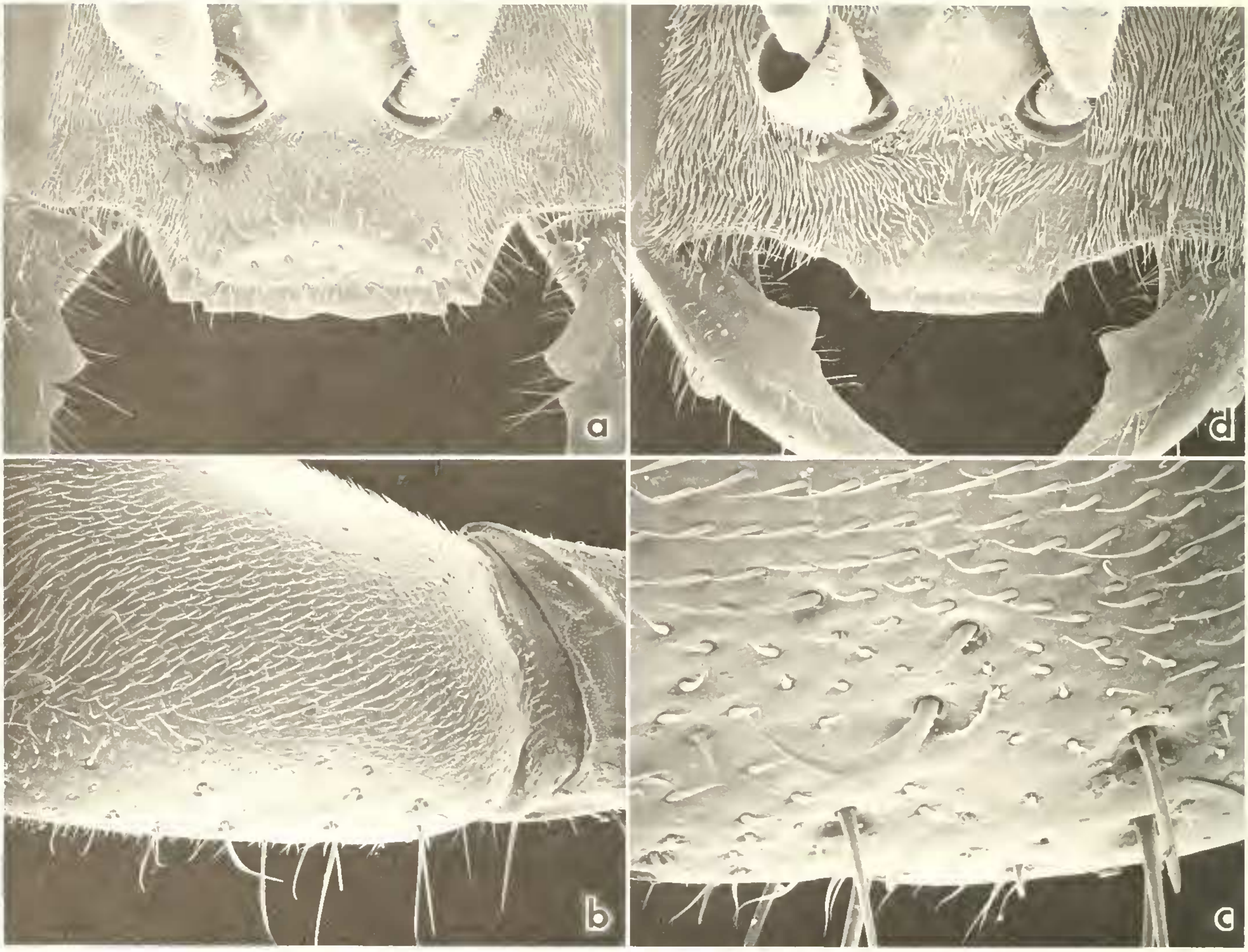

FIGURE 6. *Tachysphex montanus* (Cresson). a—female clypeus; b—forefemoral venter of female; c—same, higher magnification; d—male clypeus.

have been collected together at several localities, e.g., in Borrego Valley, Glamis, and Sagehen Creek, California; and in Cornucopia, Oregon.

The holotype male of *musitatus* is a deformed specimen with strongly depressed vertex and occiput. Otherwise it agrees with *montanus*.

LIFE HISTORY.—Females of *montanus* prey upon nymphal *Oedaleonotus* (Acrididae) according to Krombein (1967). The specimens to which he refers (USNM) were collected at Owinza, Idaho (Newton 1956). Prey length varies from 8 to 15 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 7).—Southern British Columbia to southern California and Arizona, east to Alberta, Idaho, and Colorado.

MATERIAL EXAMINED.—59♀, 59♂ (ANSP, CAS, CSDA, CU, MCZ, TLG, UCD, UIM, USNM, USU, WJP).

RECORDS (b: individuals with black gastral apex).—CANADA: **Alberta:** Writing-on-Stone Provincial Park (b). **British Columbia:** Vancouver (b).

UNITED STATES: ARIZONA: **Maricopa:** Phoenix, Rainbow Valley. **Yuma:** Parker (b). CALIFORNIA: **Glenn:** Plaskett Meadows. **Humboldt:** 5 mi NW Garberville. **Imperial:** Glamis (also 20 mi E). **Modoc:** 6 mi NW Cedarville. **Mono:** White Mts., elevation 10,000 ft (partly b). **Nevada:** Boca, Sagehen Creek near Hobart Mills. **Placer:** 5 mi NW King's Beach, Tahoe. **Plumas:** Meadow Valley. **Riverside:** 18 and 22 mi W Blythe, Hopkins Well (about 20 mi W Blythe). **San Bernardino:** 13 mi E Amboy, Needles. **San Diego:** Borrego Valley. **Siskiyou:** Dry Lake Mountain (7 mi NNW town of Klamath River), Salmon Mt. COLORADO: **Costilla:** Ute Creek, 9,000 ft (b). IDAHO: **Cassia:** Burley (b), 5 mi S Oakley (b). **Elmore:** 6 mi S Sunnyside (b). **Idaho:** Moose Creek Ranger Station near Grangeville. **Lincoln:** Dietrich Butte (partly b), Owinza (between Dietrich and Kimama), Shoshone (b). **Minidoka:** 9 mi NE Kimama (b). **Shoshone:** Clarckia (Crater Peak). NEVADA: —. OREGON: **Baker:** Cornucopia. **Jackson:** Ashland Mt. UTAH: **Cache:** Logan (b). **Iron:** Parowan Canyon. **Sevier:** Richfield. **Utah:** Provo (b). WYOMING: **County unknown:** Bridger Basin (S Gorman) (b).

Tachysphex aethiops (Cresson)

(Figures 8–9)

Larrada Aethiops Cresson, 1865:465, ♂ (incorrect original spelling).[1] Lectotype: ♂, Colorado: no specific locality (ANSP), designated by Cresson 1916:95.—In *Larra*: Patton 1879:354, 1881:389, Kohl 1885:240, Ashmead 1890:33.—In *Tachysphex*: W. Fox 1894*a*:529, Dalla Torre 1897:677, Ashmead 1899:250; Bridwell 1899:208, Rohwer 1908:223, G. Bohart 1951:950, Krombein 1958*c*:188, Evans 1970:489, 497, Alcock 1973:329, Elliott and Kurczewski 1973:80; Evans 1973:149, Steiner 1973:23, Bohart and Menke 1976:272, Krombein 1979:1627, Finnamore 1982:103.

DIAGNOSIS.—The female of *aethiops* can be recognized easily by the shiny, sparsely punctate fore- and midfemoral venter

(Fig. 8c, d), and the pygidial plate is punctatorugose in most specimens (Fig. 8b). The femoral sculpture is similar in *mirandus* and *tipai*, but in both the vertex setae are 1.0 MOD long (up to 0.6 MOD in *aethiops*), the length of flagellomere II is 3.5–4.0× width (2.8–3.2 in *aethiops*), and the wings are hyaline to moderately infumate (strongly infumate in *aethiops*). In addition, the body length and the vertex width: length ratio are: 11–13 mm and 1.5–1.7 in *aethiops*, 8–12 mm and 1.1–1.6 in *mirandus*, and 6.5–8.0 mm and 1.1–1.3 in *tipai*.

The male of *aethiops* is very similar to *montanus*. The two differ from the other species in having a dull, impunctate mesopleuron, nonfasciate terga, and a distinctive clypeus (Fig. 6d, 8e); the lobe is delimited laterally by a small but sharply defined carina that emerges from the lip corner and extends dorsad slightly beyond the lip base; the distance between the lip corners is equal to 0.8–1.0 of the clypeal length. The clypeal lobe is similar in *bohartorum* (carinate anterolaterally, width: length ratio equal to 0.7–0.8), but the excessively dense tergal punctation of that species (Fig. 30a, b) is distinctive. In other species the clypeal lobe is either narrower (*eldoradensis*, *hopi*) or markedly broader, or the lateral carina is evanescent to absent. Males of the two species are not easily separated. In most *aethiops* the gaster is all black, but it is red in some specimens (red in *montanus*, all or basally). Individuals with a red gaster have forefemoral punctures three to five diameters apart between the notch and the apex (punctures about one diameter apart in *montanus*). Some males of *aethiops* have a sparsely punctate midfemoral venter and a glabrous zone on the midtibial dorsum, features absent in other species.

DESCRIPTION.—Punctures less than one diameter apart on frons and vertex. Vertex width more than length. Mesopleuron opaque, with conspicuous, somewhat irregular microsculpture. Propodeal dorsum regularly microareolate; side with conspicuous microsculpture, sometimes densely, indistinctly ridged; hindface finely ridged. Sternum I without apicomedian depression. Midtibia posteroexternally with impunctate zone which may be broad or narrow. Scutal and femoral setae appressed, scutal setae at middle oriented almost uniformly posterad. Hindcoxa not carinate.

Body black, including legs, or gaster red; tarsal apex reddish in male. Terga not fasciate. Wings infumate (strongly in female). Frontal vestiture silvery.

♀.—Clypeus (Fig. 8a): bevel longer than basomedian area; lip almost straight, with one lateral incision on each side, scarcely emarginate mesally in some specimens. Dorsal length of flagellomere I 2.1–2.7× apical width. Scutal punctures fine, but well defined, less than one diameter apart, except discal punctures (which are two to four diameters apart). Discal micropunctures of tergum II usually more than one diameter apart. Tergum V densely punctate, apical depression impunctate (at least mesally). Pygidial plate dull, shiny apically in some specimens, punctate and rugose (Fig. 8b) or (occasional specimens) rugae inconspicuous. Trochanteral venter shiny, finely, sparsely punctate. Fore- and midfemoral venter shiny, sparsely punctate (Fig. 8c, d). Length 11–13 mm.

Vertex setae subappressed, 0.3 MOD long, except erect, 0.6 MOD long, on postocellar impression. Vestiture not obscuring sculpture between antennal socket and orbit. Midfemoral venter practically glabrous. Outer face of foretibia and dorsum of mid- and hindtibia (sometimes narrowly) glabrous.

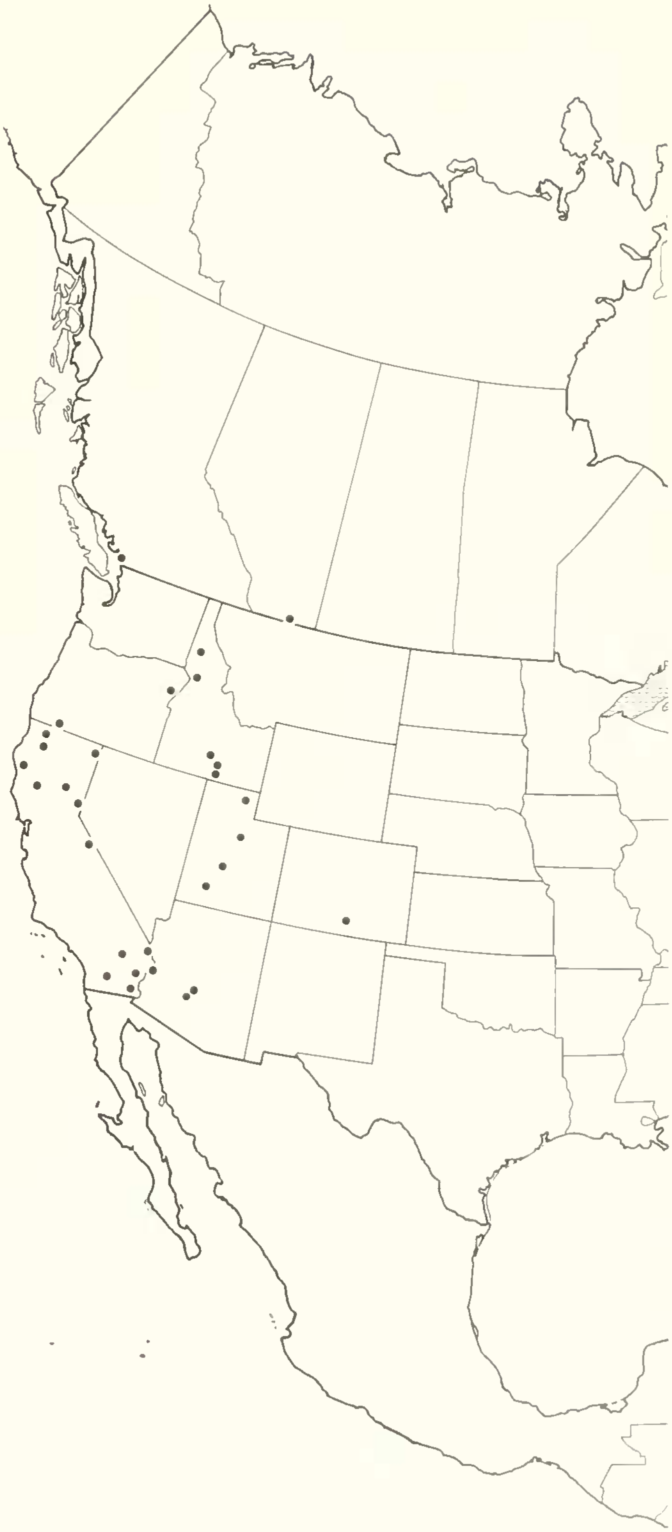

FIGURE 7. Geographic distribution of *Tachysphex montanus* (Cresson).

♂.—Mandibular inner margin with tooth (Fig. 8e). Clypeus (Fig. 8e, f): bevel shorter than basomedian area, evanescent in some specimens; lip arcuate, its corners obtuse; distance between lip corners equal to 0.8–1.0 of clypeal length and also of

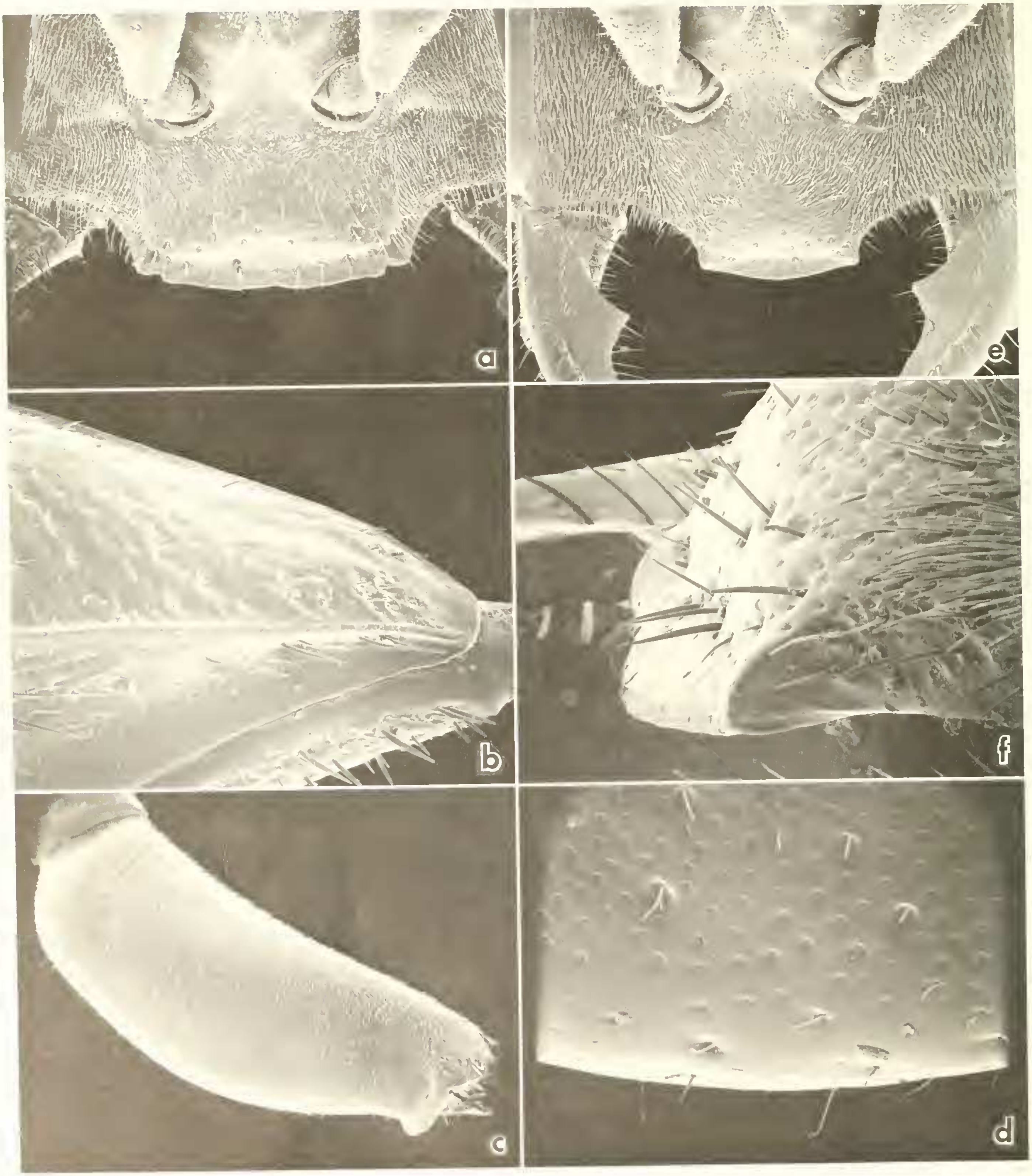

FIGURE 8. *Tachysphex aethiops* (Cresson): a—female clypeus, b—pygidial plate of female, c—female forefemur; d—sculpture of forefemoral venter of female; e—male clypeus; f—clypeal lobe of male, laterally.

TABLE 1. CHARACTERS ASSOCIATED WITH *TACHYSPHEX AETHIOPS*.

Body part	*aethiops*	Specimens with red gaster
1) Gaster	Black	All red or (some females) segments III–IV black
2) Propodeal side	Microsculptured to finely ridged	Finely to coarsely ridged
3) Female pygidial plate	Punctatorugose or (some specimens) punctate	Punctate or (some specimens) weakly punctatorugose
4) Male forefemoral venter between notch and base	Punctures one to three diameters apart	Punctures three to five diameters apart

distance between corner and orbit; a sharp carina emerges from lip corners and extends slightly beyond lip base. Dorsal length of flagellomere I 1.2–1.7× apical width. Vertex width 1.5–1.7× length. Scutal punctures distinct, subcontiguous. Discal micropunctures of tergum II about one diameter apart. Sterna densely punctate throughout. Forefemoral notch glabrous. Foretarsus with one to four preapical rake spines; apical spine of tarsomere II equal to tarsomere III or much shorter. Midfemoral venter in many specimens shiny, sparsely punctate, glabrous (sometimes median third only), hindface more or less flattened or slightly concave. Length 8.0–10.5 mm.

Vertex setae erect, 1.0 MOD long. Integument largely obscured by vestiture between antennal socket and orbit.

VARIATION.—In the male, the trochanteral venter may be densely punctate or with only a few, sparse punctures; the punctures of the midfemoral venter are subcontiguous to sparse; the midtibia is densely punctate throughout or has a glabrous, dorsal zone.

DISCUSSION.—I am provisionally assigning to *aethiops*, as its red phase, specimens that closely resemble this species in most characters but that differ in gastral color, sculpture, and punctation as detailed in Table 1. Full intergradation has not been observed.

The gaster of the red form is all red in most specimens (dark reddish in a female from Sun Pass, Oregon; UCD). Segments IV–VI are black in a female from Osoyoos, British Columbia (CNC) and in a female collected 23 mi W Dillon, Montana (UCD).

LIFE HISTORY.—*Tachysphex aethiops* nests in flat, friable sand and in hard packed soil. Females dig their own nests (Evans 1970), but Alcock (1973) twice observed females entering open *Bembix* burrows; one remained inside the nest for over one hour, and the other modified a probable *Bembix* sleeping burrow for her nest. An active nest has two or three cells, and Evans (1970) noted a low, spreading mound of sand (8 cm wide by 5 cm long) in front of the nest entrance. The nest is oblique to the surface: the burrow length is 10–12 cm, and the cell is located at a depth of 4–6 cm. Recorded prey are immature Acrididae, *Trimerotropis* sp., probably *T. suffusa* Scudder, and only one is placed in a cell (Evans 1970, 1973; Alcock 1973). Prey length (12–20 mm) exceeded that of the wasp. The egg is attached to the forecoxal membrane of the hopper and extends transversely over the other forecoxa, with its posterior end free (Evans 1973).

Evans (1970) found a male of this species among the prey of *Philanthus pulcher* Dalla Torre.

GEOGRAPHIC DISTRIBUTION (Fig. 9).—The black form of *aethiops* ranges between Northwest Territories of Canada to southern California and central New Mexico. It is transcontinental in Canada and also occurs in the Great Lakes area and in Nebraska, but west of the 100th meridian in the remaining United States. The red form of *aethiops* occurs between southern British Columbia and southern Colorado, southern Arizona, and northern Baja California.

MATERIAL EXAMINED.—Black form: 415♀, 506♂; red form: 15♀, 36♂ (CNC, KU, LACM, UCD, UCR, UIM, USNM).

RECORDS (r: gaster red, all localities recorded).—CANADA. **Alberta:** Banff, Edmonton, Fort McMurray, Jumping Pd. Creek (20 mi W Calgary), 12 km SW Orion, Slave Lake, Writing-on-Stone Provincial Park. **British Columbia:** Galiano, Hell's Gate, Manning Provincial Park, Mt. Robson, Nicola, Osoyoos (r). **Northwest Territories:** Fort Providence, Fort Simpson, Fort Smith, Hay River, Rae, Yellowknife. **Ontario:** Kenora. **Quebec:** Tadoussac. **Saskatchewan:** Snowden, 5 mi E Swift Current.

UNITED STATES: ARIZONA: **Cochise:** Elfrida (r). **Coconino:** Grand Canyon (North Rim). **Maricopa:** 5 mi N Mesa (r). **Navajo:** Kayenta (r). **Pinal:** Apache Junction (r). CALIFORNIA. **Alpine:** Hope Valley (partly r) and five other localities. **Amador:** Ham's Station (Highway 880). **Calaveras:** Big Meadows. **Contra Costa:** Mt. Diablo. **El Dorado:** Strawberry (partly r) and nine other localities. **Fresno. Humboldt:** Big Lagoon, 1 mi S Blue Lake, 10 mi S Orick. **Inyo. Lassen:** Hallelujah Junction (r) and four other localities. **Madera:** Green Mt. (SE slope). **Modoc. Mono:** Mammoth Lakes (partly r), White Mts. (partly r) and seven other localities. **Nevada. Placer. Plumas:** Bucks Lake, 6 mi E Chester, Johnsville, Meadow Valley. **Riverside:** 10 mi NW Cottonwood (r), Hopkins Well (r). **San Bernardino:** 18 mi E Amboy (r), Dollar Lake trail, Fish Creek, Vidal Junction (r). **San Diego:** Borrego Springs (r). **Shasta. Sierra. Siskiyou. Trinity:** 10 mi W Coffee Creek, Lower Mumbo Lake (NE corner of county). **Tulare. Tuolumne. Ventura:** Hungry Valley (5 mi S Gorman, r). COLORADO: **Boulder. Chaffee:** Middle Cottonwood Creek in Sawatch Mts., Poncha Springs. **Clear Creek:** Chicago Creek, Loveland Pass, Mt. Evans (Dolittle Ranch). **Costilla:** Ute Creek (r). **Gunnison:** Gothic, Jack's Cabin (15 mi SE Crested Butte), Ohio. **Lake:** Leadville. **Larimer. Ouray:** Ouray. **Mesa:** 31 mi N Mack. **Mineral:** Creede, South Clear Creek. **Routt:** 15 mi S Steamboat Springs. **Teller:** Florissant. Also: locality unknown (r). IDAHO: **Bear Lake:** 5 mi W Ovid, Paris. **Bingham:** Taber (r). **Blaine:** Alice Lake (Sawtooth Mts.), Galena Summit. **Boise:** Garden Valley. **Boundary:** Highway 95 (3 mi S British Columbia). **Butte:** Bear Pass, Craters of the Moon National Monument (partly r). **Canyon:** 7 mi S Nampa. **Clark:** 3 mi NW Kilgore. **Clearwater:** Elk River. **Custer:** Bonanza, Farley Lake (Sawtooth Mts.). **Idaho:** 25 mi E Lowell. **Kootenai:** Lane. **Latah:** 2 mi E and 5 mi N Bovill. **Lincoln:** Shoshone (r). **Owyhee:** Murphy Hot Springs (r), 4 mi NE Reynolds (r). **Shoshone:** 7 mi E Avery. **Teton:** 4 mi W Tetonia, Victor. **Valley:** 2 mi SE McCall. MICHIGAN: **Alger:** Pictured Rocks National Lakeshore. **Marquette:** Huron Mountain Club. MINNESOTA. **Carlton:** Sawyer. MONTANA: **Beaverhead:** 23 mi W Dillon (r). **Madison:** 9 mi N Ennis. **Ravalli:** Hamilton. NEBRASKA: **Thomas:** 2.5 mi W Halsey. NEVADA: **Carson City. Douglas:** Spooners Lake N Junction Highway 28. **Elku:** 7 mi S Carlin (r) and five other localities. **Eureka:** Eureka. **Storey:** Virginia City (r). **Washoe:** Galena Creek, Incline Village, Mt. Rose. **White Pine:** Mt. Wheeler, Snake Creek. NEW MEXICO: **Sandoval:** Jemez Springs. **Santa Fe:** Little Tesuque Canyon. OREGON: **Baker:** Cornucopia. **Grant:** Antelope Mt. **Hood River:** Mt. Hood. **Klamath:** Crater Lake Park (Pole Bridge Meadow), 4 mi N Crescent, Lake of the Woods, Sun Pass (r). **Lake:** Hart Mt. Reserve. **Union:** North Powder. **Wallowa:** Hat Point. SOUTH DAKOTA: Black Hills National Forest. UTAH. **Cache. Daggett:** Hideout Canyon near Manila. **Garfield:** Blue Spruce Camp (18 mi N Escalante), 15–16 mi N Boulder. **Rich:** Logan Canyon summit, Monte Cristo, Park City. **Sanpete:** Flat Canyon Camp (33 mi NW Huntington). **Uintah:** Little Brush Creek (25 mi N Vernal), N Fork Duchesne River. **Weber:** Willow Flat. WASHINGTON: **King:**

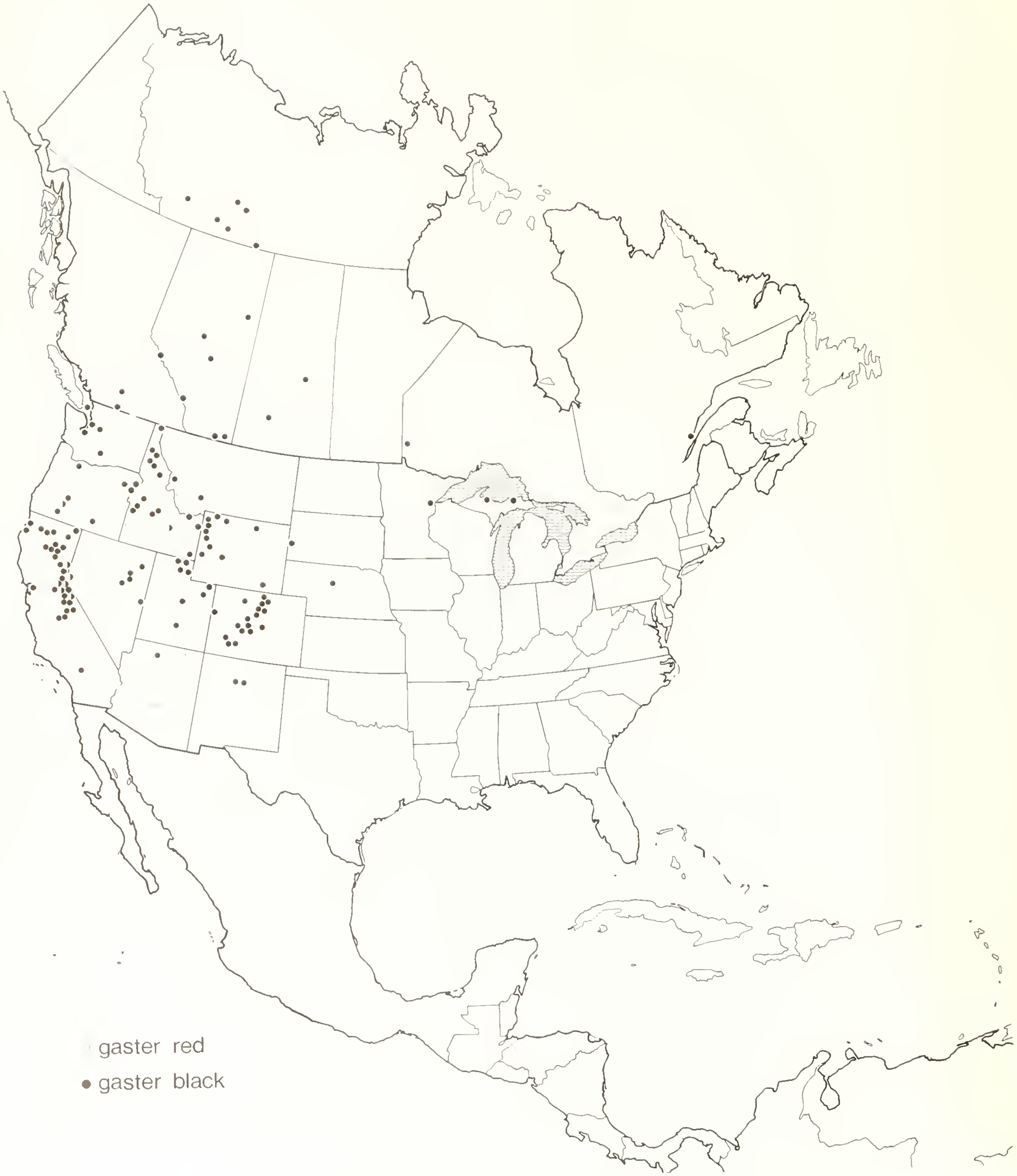

FIGURE 9. Geographic distribution of *Tachysphex aethiops* (Cresson).

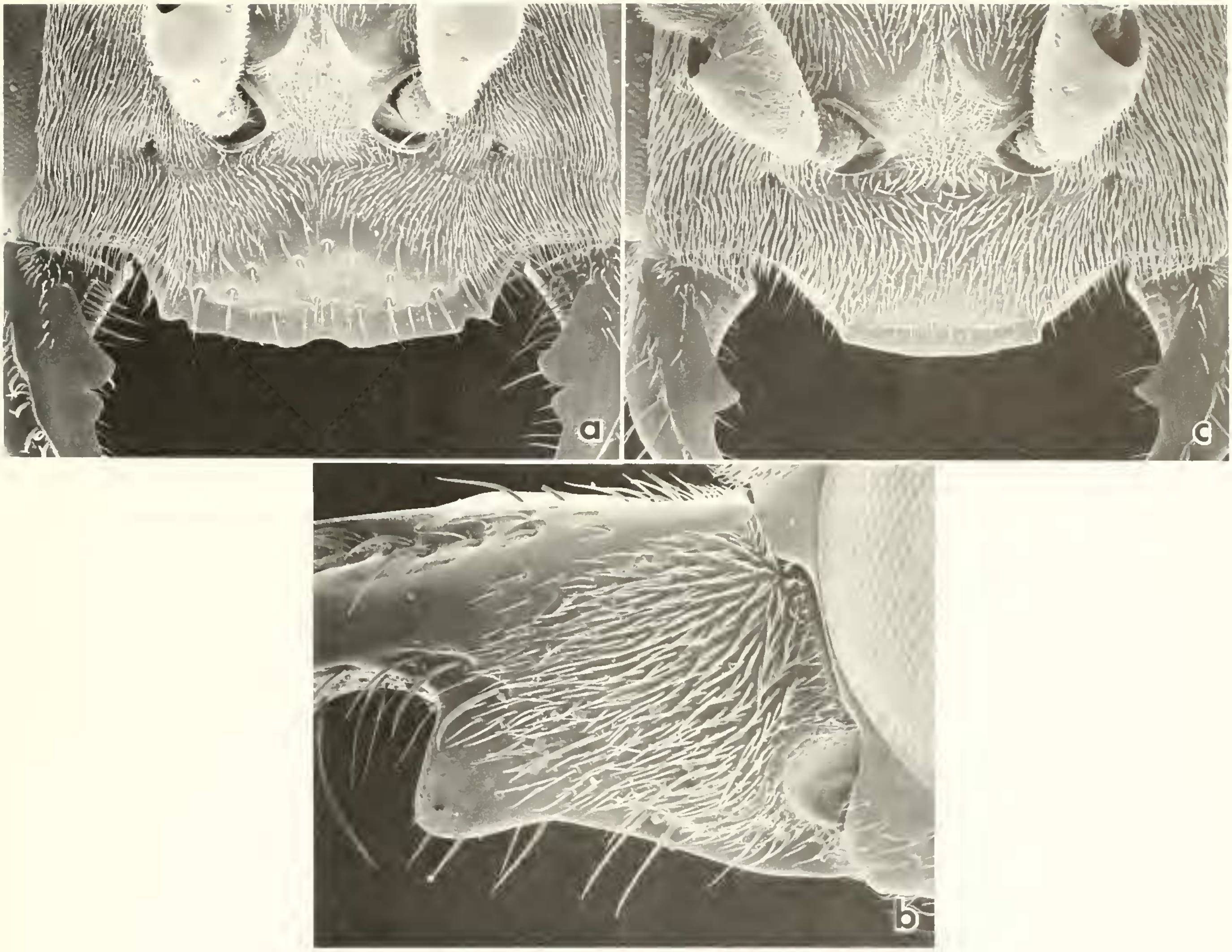

FIGURE 10. *Tachysphex orestes* sp. n.. a—female clypeus; b—female mandible; c—clypeus of presumed male.

Seattle. **Kittitas:** Cooper Lake. **San Juan:** Friday Harbor. **Thurston:** Olympia **Yakima:** Yakima. WYOMING: **Albany:** Summit. **Fremont:** Shoshone National Forest. **Park:** Lake Creek Camp (13 mi SE Cooke City), Sunlight Basin N Cody. **Sheridan:** Big Horn, Big Horn National Forest. **Sublette:** Pinedale, Sacajawea Camp (24 mi W Big Piney). **Teton.**

MEXICO: **Baja California Norte:** near La Zapopita in Valle de Trinidad (r).

Tachysphex orestes sp. n.

(Figures 10, 11)

DERIVATION OF NAME.—Orestes is a Greek word meaning mountaineer; noun in apposition.

DIAGNOSIS.—*Tachysphex orestes* has a dull, unevenly microsculptured mesopleuron. The female can be recognized by the following combination of characters: clypeal lip incised laterally, shallowly emarginate mesally; venter of mid- and hindtrochanters shiny, in most specimens impunctate or sparsely punctate; mesopleural setae suberect on hypoepimeral area and appressed or nearly so beneath the scrobe; and gaster all red (at least the sterna). Unlike *eldoradensis*, the setae of the postocellar impression are shorter than 0.5 MOD (about 1.0 MOD long in that species), and the silvery tergal fasciae are well defined (inconspicuous in *eldoradensis*). In addition, the mandibular ventral margin of *orestes* is convex basally (Fig. 10b) and the vertex width is 1.2–1.4 × length, while in *eldoradensis* the mandibular ventral margin is straight basally in many specimens, and the vertex width is 1.4–1.6 × length.

DESCRIPTION.—Mandibular ventral margin sinuate between base and notch (convex near base), but weakly so in some specimens. Punctures less than one diameter apart on frons, vertex, and scutum. Mesopleuron microsculptured, at most with ill-defined punctures. Mesothoracic venter densely punctate. Propodeal dorsum microareolate, side microsculptured, in some specimens also partly microridged; hindface finely ridged. Sternum I without apical depression. Hindcoxa not carinate or with rudimentary basal carina.

Setae not concealing integument between antennal socket and orbit, appressed on vertex, uniformly oriented posterad on scutum, nearly erect on hypoepimeral area, appressed or nearly so beneath mesopleural scrobe, diverging anterad on propodeal dorsum.

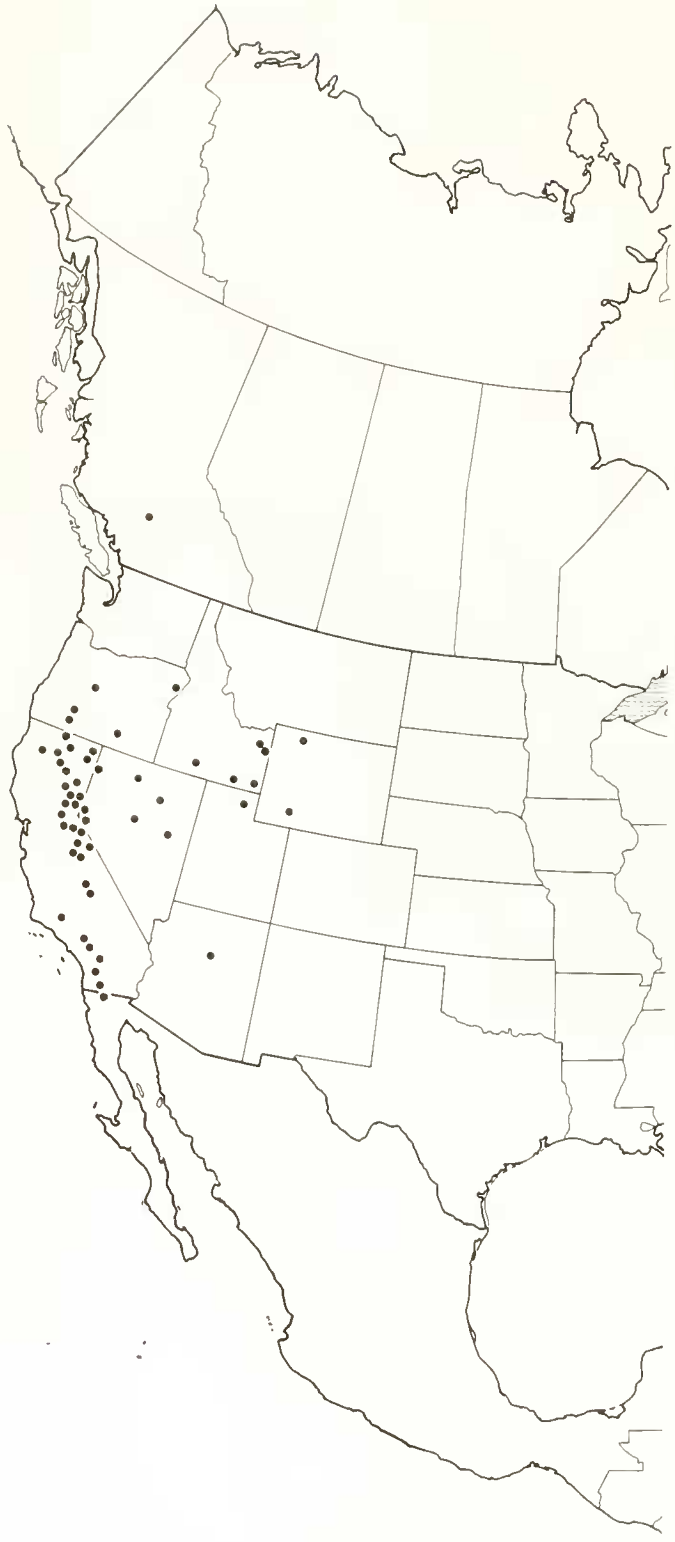

FIGURE 11. Geographic distribution of *Tachysphex orestes* sp. n.

Head, thorax, and legs black (tarsomeres II–V or III–V ferrugineous), gaster red in most specimens, but apical terga black in single female from British Columbia. Terga I–III fasciate apically. Wings moderately infumate. Frontal pilosity silvery.

♀.—Clypeus (Fig. 10a): bevel longer than basomedian area; lip arcuate, incised laterally, notched mesally (notch evanescent in some specimens, absent in worn specimens). Dorsal length of flagellomere I 2.2–2.4 × apical width. Vertex width 1.2–1.4 × length. Discal micropunctures of tergum II evanescent, two to three diameters apart. Tergum V: punctures averaging two to three diameters apart mesally; apical depression impunctate. Pygidial plate shiny, punctate. Femora finely, uniformly punctate. Trochanteral venter shiny, impunctate or with sparse, inconspicuous punctures (fore- and midtrochanter densely punctate in some specimens). Length 7.5–10.0 mm.

♂.—Unknown. The clypeus of a male that probably belongs to this species is shown in Figure 10c.

DISCUSSION.—*Tachysphex orestes* is common in many places in the Sierra Nevada, California, and many males must have been represented in the material I have studied. Nevertheless, I have not been able to clearly distinguish them from males of some other phena that still remain undefined. As a result, the male of *orestes* has not been included in the present revision.

GEOGRAPHIC DISTRIBUTION (Fig. 11).—Montane areas between British Columbia and Baja California Norte, east to Idaho, Wyoming, and central Arizona.

COLLECTING PERIOD.—13 May (Baja California Norte), 23 May–5 August (United States and Canada).

MATERIAL EXAMINED.—Holotype: ♀, California: Placer: Carnelian Bay, 10 July 1975, WJP (CAS, Type #15906).

Paratypes (236♀): CANADA. **British Columbia:** Skihist Camp near Lytton (on Frazer River), EIS (1♀, UCD).

UNITED STATES. ARIZONA. **Coconino:** Ft. Valley (Flagstaff), collector unknown (1♀, UCD). CALIFORNIA. **Alpine:** Hope Valley, PDH, JWMS (2♀, UCD); Red Lake, MEI (2♀, UCD); 1.5 mi NE Red Lake, EIS (1♀, UCD); no specific locality, A. C. Browne (1♀, LACM). **Amador:** Ham Station, F. E. Strong (1♀, UCD). **Calaveras:** Big Meadow, ASM (1♀, UCD). **El Dorado:** Blodgett Forest (18 mi E Georgetown), JAP (2♀, CIS) and JWMS (1♀, CIS), Echo Lake, J. C. Downey (1♀, UCD); Fred's Place, R. O. Schuster (1♀, UCD), 8 mi NE on Icehouse Road, R. B. Kimsey (1♀, UCD), WJP (3♀, CAS), Kyburz, S. C. Kuba (2♀, CAS), Meyers, MEI (1♀, UCD). **Fresno:** Deadman Canyon in Kings Canyon National Park, R. E. Rice (1♀, UCD), Huntington Lake, L. McCracken (1♀, UCD). **Inyo:** Big Pine Creek, RMB, FDP (2♀, UCD). **Kern:** Mt. Pinos, JAP (1♀, CIS). **Lassen:** Hallelujah Junction, MEI, J. A. Miller (3♀, UCD), Susanville, TRH (5♀, CSDA). **Los Angeles:** Blue Ridge in San Gabriel Mts., R. R. Snelling (1♀, LACM). **Modoc:** 5 mi NE Alturas, TRH (1♀, CSDA); 14 mi N Alturas, V. L. Vesterby (1♀, UCD); Cedar Pass, D. L. Dahlsten (1♀, UCD), collector unknown (1♀, CNC); Fandango Pass, TRH (1♀, CSDA). **Mono:** Cottonwood Creek, G. I. Stage, G. W. Frankie (2♀, CIS), Crowley Lake, O. C. Lafrance (1♀, LACM); Parker Creek 8 mi S Lee Vining, WJP (1♀, CAS); White Mts. (Blanco Corral), JWMS (2♀, UCD). **Nevada:** Boca, RMB, PMM (2♀, UCD), WJP (1♀, WJP), Hobart Mills, RMB (1♀, UCD); Russell Valley, J. A. Froebe (1♀, UCD); Sagehen Creek near Hobart Mills, RMB, R. C. Blaylock, R. L. Brumley, M. A. Chambers, DSH, MEI, L. S. Kimsey, JAP (3♀, BMNH; 4♀, CAS, 26♀, UCD), M. C. Axtman (1♀, LACM), WJP (1♀, WJP); 7 mi SE Truckee, RMB (2♀, UCD). **Placer:** Carnelian Bay on Lake Tahoe, RMB, B. Villegas (23♀, UCD, 3♀, USNM), WJP (1♀, CAS), W. Turner (2♀, WSU), Dollar Point 2 mi NE Tahoe City, P. Adams (3♀, CSDA); Lake Tahoe, collector unknown (1♀, UCD); Nyack (12 mi W Emigrant Gap), WJP (1♀, CAS); Serene Lakes 3–4 mi S Soda Springs, P. Buickerood (2♀, CAS), Tahoe, FXW (5♀, UCD). **Plumas:** Bucks, collector illegible (2♀, UCD), 6 mi E Chester, RMB (2♀, UCD), 14 mi W Johnsville, M. R. Gardner (2♀, UCD). **Riverside:** Pine Cove (San Jacinto Mts.), E. S. Ross (1♀, UCD). **San Bernardino:** Fish Creek in San Bernardino Mts., KWC (1♀, CAS). **San Diego:** Corte Madera, DKF (1♀, SDNH), Laguna Mts., R. B. Parks (1♀, SDNH); Mount Laguna, PDH (1♀, CIS) and JAP (1♀, CIS); Mount Palomar, R. L. Langston (1♀, CIS). **Shasta:** Hatchet Mt. Pass, TRH (1♀, CSDA), 5 mi NE Old Station (4♀, CSDA). **Sierra:** Gold Lake, C. L. Fox, G. A. Schaefers (2♀, UCD), HKC (1♀, CAS), Independence Lake, RMB, R. L. Brumley, JAP (5♀, UCD), Packer Lake, R. L. Westcott (1♀, UCD); Sierra Buttes, E. J. Montgomery (2♀, UCD); Sierraville, FDP (1♀, UCD), Yuba Pass, RMB, MEI, L. S. Kimsey, E. J. Montgomery (6♀, UCD). **Siskiyou:** Ash Creek Ranger Station (9 mi E McCloud), REC (2♀, UCD), Ash Creek Ranger Station at McCloud River, WWM (1♀, CIS); 3 mi E Ash Creek Ranger Station, REC (1♀, CIS) and J. Doyen (1♀, CIS), Dorris, WJP (1♀, CAS), Lower Devil's Peak, TLG (1♀, TLG), 3 mi N Medicine Lake, J. Schuh (1♀, UCD),

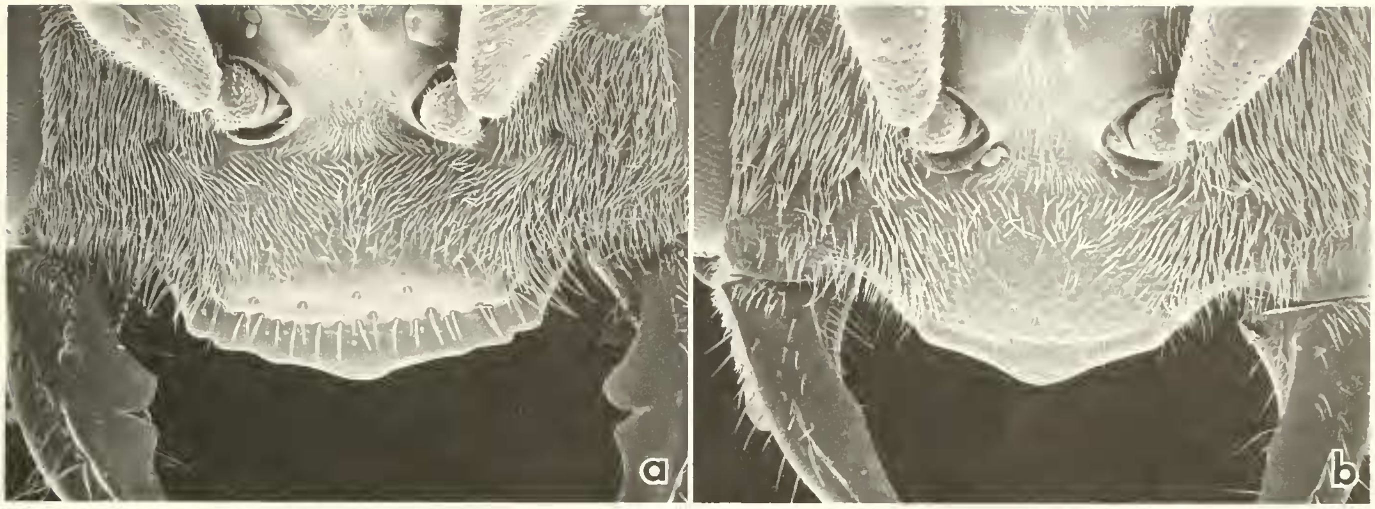

FIGURE 12. *Tachysphex angelicus* sp. n.: a—female clypeus; b—male clypeus.

Mt. Shasta town, JAP (1♀, CIS), WJP (3♀, CAS). **Trinity:** Coffee Creek 10 mi W Ranger Station, RMB (1♀, UCD), 10 mi N Coffee Creek Ranger Station, JWMS (2♀, CIS). **Tulare:** Nine Mile Canyon (5 mi E Smith Meadow), C. W. O'Brien, Potwisha (junction of Marble and Middle forks of Kaweah River), E. C. Van Dyke (1♀, UCD). **Tuolumne:** Kennedy Meadow, R. H. James (1♀, UCD); Strawberry, RMB, A. T. McClay, W. T. Crites, R. H. James, EGL (7♀, UCD). COLORADO: **County unknown:** MacDoel, J. Schuh (2♀, UCD). IDAHO: **Bear Lake:** Montpellier, collector unknown (1♀, AMNH). **Fremont:** St. Anthony Sand Dunes, MSW (2♀, CSDA). **Oneida:** 5 mi NW Holbrook, W. J. Hansen (2♀, USU). **Teton:** Grand Teton, collector unknown (1♀, UCD). **Twin Falls:** Castleford, collector unknown (1♀, USNM). NEVADA. **Douglas:** Genoa, FDP (2♀, UCD). **Elko:** 7 mi NE Carlin, FDP (1♀, UCD). **Humboldt:** Paradise Valley, FDP (1♀, UCD); Santa Rosa Ranch, ASM (1♀, UCD). **Lander:** Austin, RMB (1♀, UCD). **Washoe:** 21 mi SE Eagleville, California, P. Opler (1♀, CIS), Mt. Rose (Galena Creek), RMB (2♀, UCD), FDP (1♀, NSDA); 4 mi W Wadsworth, R. B. Miller (1♀, FSDA). **White Pine:** 34 mi W Ely, RMB (1♀, UCD). OREGON. **Deschutes:** Tumalo Reservoir, EIS (1♀, UCD). **Klamath:** Crater Lake National Park, Schuh, Hansen, and Miller (1♀, UCD); Eagle Ridge (Klamath Lake), C. L. Fox (1♀, UCD); base of Mt. Pitt, Vertrees and Schuh (1♀, UCD); Lake of the Woods, H. A. Scullen (1♀, UCD), Sand Creek near Crater Lake, J. Schuh (4♀, UCD). **Lake:** Warner Lake, E. C. Van Dyke (1♀, UCD). **Wallowa:** Lick Creek Ranger Station in Wallowa National Forest, D. Bolinger and S. G. Jewett (1♀, OSU). UTAH: **Bonanza:** SW Bonanza, 1524–1706 m, M. Schwartz (1♀, CAS, 1♀, USU). **Box Elder:** 15 mi W Snowville, J. Hansen (1♀, USU). **Cache:** Blacksmith Fork Canyon, W. J. Hansen (1♀, CAS, 2♀, USU). **Emery:** Orange Olsen Ranger Station, P. K. Cowley (2♀, CAS; 2♀, USU). **Rich:** Logan Canyon summit, Malaise trap (1♀, USU). WYOMING: **Park:** Sunlight Basin N Cody, GEB (1♀, UCD). **Sweetwater:** Green River, collector unknown (2♀, AMNH, UCD).

MEXICO: **Baja California Norte:** 1 mi S El Cóndor, JWB and DKF (1♀, SDNH).

Tachysphex angelicus sp. n.

(Figures 12, 13)

DERIVATION OF NAME.—Angelicus is a Latin masculine adjective derived from angelus, an angel; with reference to the Los Angeles area of California, where most specimens have been collected.

DIAGNOSIS.—The female of *angelicus* can be recognized by the shape of the clypeal lip, which is obtusely triangular mesally (Fig. 12a). Some *spatulifer* are similar, but in that species the lip surface has several shallow concavities (lip surface flat or nearly so in *angelicus*) and the midflagellar articles are shorter (e.g., the length of flagellomere II is 3.0–3.4× width in *angelicus* and 2.3–2.4 in *spatulifer*). Unlike *tahoe*, which is somewhat similar, the vertex setae of *angelicus* are markedly inclined (erect in *tahoe*), and the body length is 12.5–13.0 mm (6.5–8.0 mm in *tahoe*).

The male of *angelicus* has an obtusely triangular or markedly sinuate clypeal lip (Fig. 12b), almost nondentate mandible, a dull mesopleuron with ill-defined punctures, nearly appressed vertex setae, the midscutal setae oriented posterad, and finely, uniformly setose sterna. Other species are similar, but they differ as follows: vertex setae erect in *mirandus*, *psammobius*, *tipai*, most *tahoe*, and some *crenulatus*; sterna II–IV largely glabrous in *mirandus*; sterna III and IV velvety pubescent in *musciventris* and *tahoe*. Most similar are *crenulatus* and *spatulifer*, but their midflagellar articles are shorter than in *angelicus*; e.g., the length of flagellomere II is 1.6–1.8× width in these two species, but 2.0–2.2× in *angelicus*. Furthermore, the clypeal lip corners of *angelicus* are closer to orbits than to each other (closer to each other than to orbits in *crenulatus*), and the trochanteral venter of *angelicus* is densely punctate (sparsely punctate in most *crenulatus*).

DESCRIPTION.—Punctures nearly contiguous on frons below midocellus, scutum, and mesothoracic venter; on vertex nearly contiguous in male, locally up to one or two diameters apart in some females. Mesopleuron dull, microsculptured, with shallow, ill-defined punctures. Propodeal dorsum evenly microareolate; side ridged in most females (ridges evanescent in the specimen from Walker Spring), evenly microsculptured or microridged in male; hindface ridged. Sternum I without apical depression.

Integument not entirely concealed by vestiture between antennal socket and orbit. Setae: on vertex markedly inclined anterad but not appressed, up to 0.7 MOD long; on midscutum oriented posterad; on mesopleuron markedly inclined but not appressed; on propodeal dorsum oriented obliquely anterad (divergent anterad); on midfemoral venter appressed or nearly so.

Head, thorax, and legs black, tarsal apex reddish (inner face of hindfemur reddish in single female from Plumas County). Gaster red or (some males) terga V–VII black. Frontal vestiture silvery. Terga I–III silvery fasciate apically. Wings weakly infumate.

♀.—Clypeus (Fig. 12a): bevel about as long as basomedian area; lip arcuate, obtusely triangular mesally, undulate laterally.

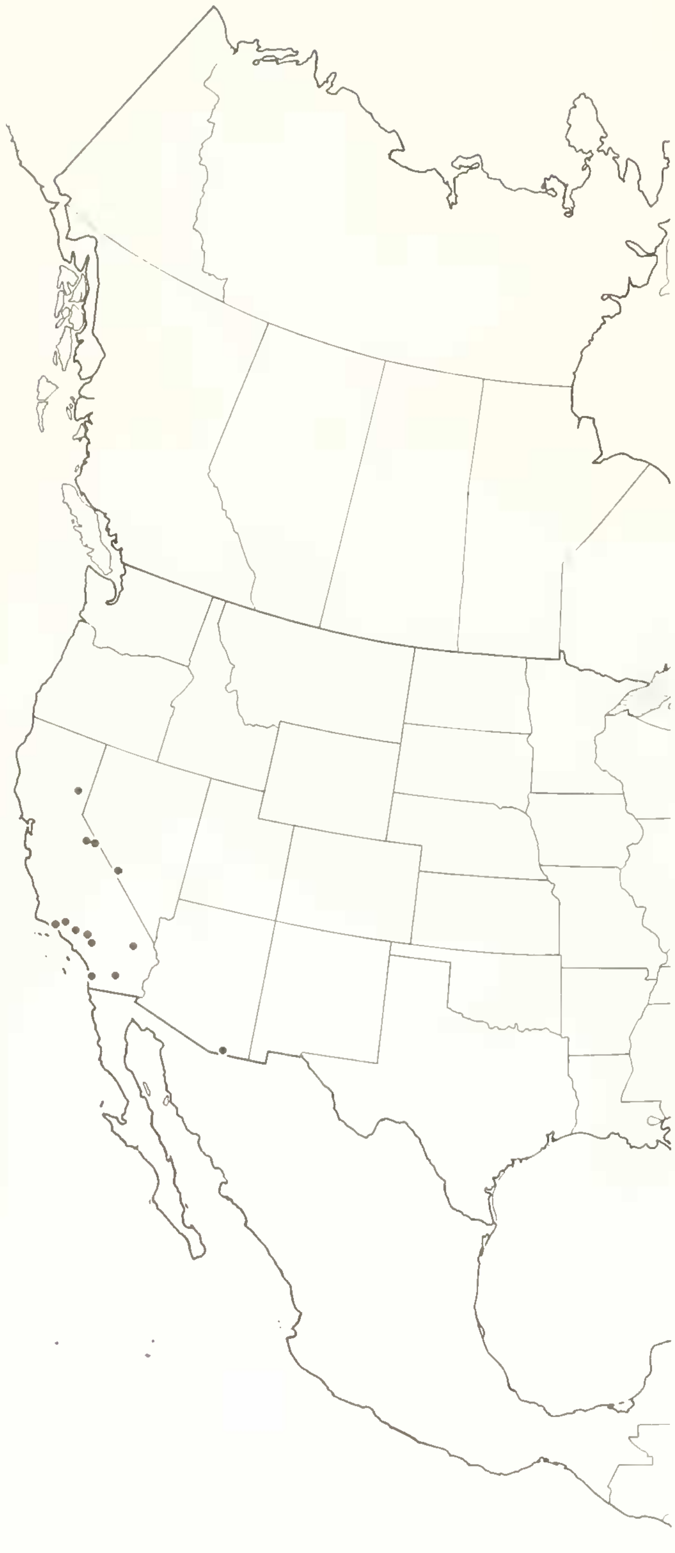

FIGURE 13. Geographic distribution of *Tachysphex angelicus* sp. n.

Dorsal length of flagellomeres I and II 2.3–2.5 and 3.0–3.4 × apical width, respectively. Vertex width 0.9–1.2 × width. Tergum V with scattered punctures, its apical depression impunctate. Pygidial plate alutaceous, shiny, sparsely punctate. Trochanteral venter finely, densely punctate. Length 7.5–12.0 mm.

♂.—Mandibular inner margin practically not dentate (Fig. 12b), tooth reduced to a small, very obtusely angulate projection. Clypeus (Fig. 12b): bevel ill defined; lip obtusely angulate or markedly sinuate, its corners ill defined, separated by a distance equal to 1.0–1.1 of clypeal length and to about 1.1 of distance between corner and orbit. Dorsal length of flagellomeres I and II 1.4–1.7 and 2.0–2.2 × apical width, respectively. Sternal punctures slightly finer than those on mesothoracic venter. Forefemoral notch pruinose. Forebasitarsus without preapical rake spines; outer apical spine of foretarsomere II shorter than tarsomere width. Length 5–9 mm.

LIFE HISTORY.—The holotype female was collected on flowers of *Eriogonum fasciculatum* Benth.

GEOGRAPHIC DISTRIBUTION (Fig. 13).—Southeastern Arizona, California, and adjacent areas of southwestern Nevada.

COLLECTING PERIOD.—10 April to 22 July.

MATERIAL EXAMINED.—Holotype ♀, California: San Diego Co.: 1 mi S Del Mar, 1 July 1963, PDH (CIS, on indefinite loan to CAS, CAS Type #15902).

Paratypes (27♀, 16♂). UNITED STATES: ARIZONA: **Cochise:** Huachuca Mts. 15 mi S Sierra Vista, 21 May 1967, Sternitzky (1♂, CNC). CALIFORNIA: **Los Angeles:** Little Rock, 21 May 1966, collector unknown (1♂, LACM); Llano, 1 June 1957, W. F. Simonds (1♀, UCD). Tanbark Flat, 25 June and 16 July 1956, RMB (1♀, CAS, 2♂, UCD); Wrightwood, 82 E 31 (31 May 1982), KWC (1♀, CAS). **Mono:** 11 mi N Bridgeport, 7 July, RMB (1♂, UCD), Mammoth Lake, 22 July 1936, RMB and GEB (1♂, UCD). **Plumas:** Little Long Valley (6 mi E Spring Garden), 6–10 Aug, MSW (1♂, CSDA). **Riverside:** Pinyon Flats, 13 June 1966, WWM and D. C. F. Rentz (1♀, CIS). **San Bernardino:** 1 mi S Adelanto, 1 June, MEI (1♂, CAS); Cajon, 17 and 19 July 1956, RCB (2♂, CAS, UCD), 17 July 1956, H. R. Moffitt (1♀, CAS); 4.3 mi NNW Granite Pass, 24 May 1983, TLG (1♀, USU), 10 mi N Lake Arrowhead, 15 June 1960, P. E. Paige (1♂, UCD). **San Diego:** 1 mi S Del Mar, 1 July 1963, C. H. Frady (1♂, OSU), Encinitas, 6 June 1934, H. L. McKenzie (1♂, UCD), Borrego Valley (Palm Canyon), 10 Apr 1957, R. W. Bushing (1♂, CAS). **Santa Barbara:** Bluff Camp in San Rafael Mts., 29 June 1959, RMB (1♀, UCD). **Tulare:** Whitney Portal, Wylie (1♀, SDNH). **Ventura:** Hungry Valley (5 mi S Gorman), 4 May 1959, PDH (1♀, CIS), and 6 May 1959, C. W. O'Brien (2♂, CAS, 2♂, CIS); Wagon Road No. 2 Campground (18 air mi WSW Gorman), 4 and 5 July 1968, PHA (5♂, 10♂ CAS). NEVADA: **Esmeralda:** Walker Springs (circa 37°22'N, 117°37'W), HKC, 3 July 1960 (1♀, UCD).

Tachysphex acutus (Patton)

(Figures 14–15)

Larra acuta Patton, 1881:390, ♂. Syntype ♂♂, Connecticut: New Haven Co.: Waterbury (destroyed). Neotype ♂, Connecticut: Litchfield Co.: Colebrook, August 1918, W. M. Wheeler (MCZ), **present designation.**—Patton 1881:388, Kohl 1885:240.—In *Tachysphex*: Fox 1894a:521, Dalla Torre 1897:677, Ashmead 1899:250, H. Smith 1908:380; J. Smith 1910:683, Williams 1914:171, Rohwer 1916:687, Mickel 1918:423, Robertson 1928:71, 92, 121, 128, 163, 195, 201, Brimley 1938:443, G. Bohart 1951:950, Bohart and Menke 1976:272; Krombein 1979:1627, Finnamore 1982:101.

Tachysphex bruesi Rohwer, 1911:577, ♀, ♂. Holotype ♀, Wisconsin: Milwaukee Co.: no specific locality (USNM). Synonymized by G. Bohart 1951:950.

Tachysphex sepulcralis: Krombein 1958a:52 (♀).

DIAGNOSIS.—*Tachysphex acutus* differs from other *Tachysphex* (except *punctifrons*, in which the subalar fossa is carinate below) in having an angulate inflexion or weak carina between the dorsal end of the postspiracular carina and the anterior end of the subalar carina (Fig. 14b) and also a longitudinal, broad keel on the basal half of sternum I (Fig. 14c). The black body, the dull, impunctate (at least posteriorly) mesopleuron, and nonfasciate tergum IV are subsidiary diagnostic characters.

DESCRIPTION.—Frons, vertex, and scutum punctate; frontal punctures subcontiguous; vertex and scutal punctures subcontiguous or (some individuals) some punctures slightly more than one diameter apart. Mesopleuron dull, densely, shallowly punctate in anterior half (almost entirely so in certain males). Subalar

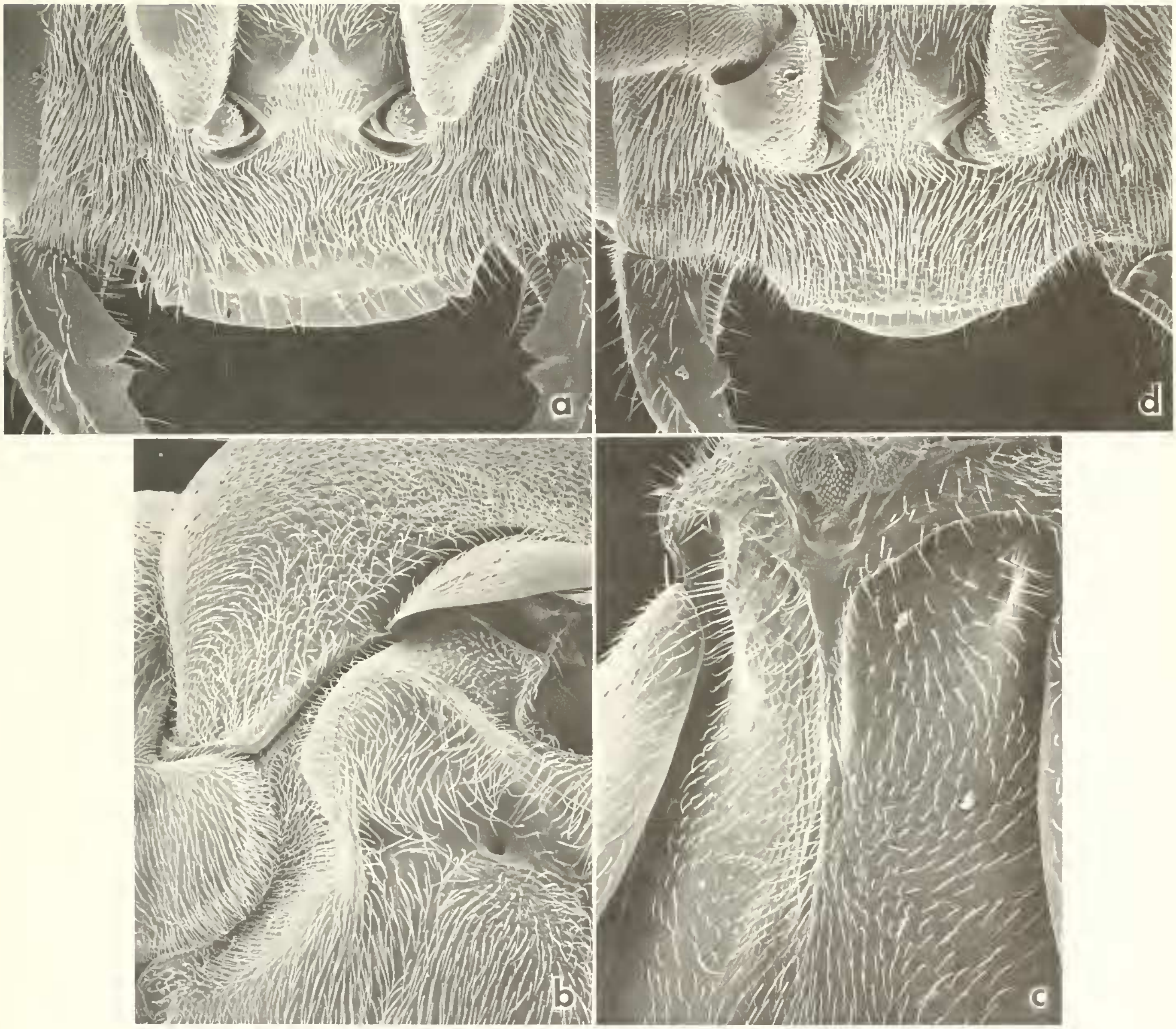

FIGURE 14. *Tachysphex acutus* (Patton): a—female clypeus; b—pronotal lobe and anterior part of female mesothorax, c—female sternum I; d—male clypeus.

fossa delimited anteriorly by an angulate inflexion or weak carina that extends between postspiracular carina and anterior end of subalar carina (Fig. 14b). Propodeum dull, dorsum microareolate, usually also ridged or rugose, side ridged (ridges indistinct in some females, evanescent in certain small males), hindface ridged. Discal micropunctures of tergum II one to two diameters apart. Sternum without apical depression, its basal half with broad, mesal keel (Fig. 14c). Hindcoxa not carinate.

Vestiture not obscuring integument between antennal socket and orbit. Vertex setae 0.5 MOD long, suberect (female) or erect (male); scutal setae 0.5–0.6 MOD long, at middle oriented almost uniformly posterad; midfemoral venter with appressed setae.

Body black. Terga I–III silvery fasciate apically. Wings weakly infumate. Frontal vestiture silvery.

♀.—Clypeus (Fig. 14a): bevel slightly shorter than basomedian area; lip arcuate, indented laterally. Dorsal length of flagellomere I 1.7–2.1 × apical width. Vertex wider than long. Tergum V densely punctate, apical depression usually impunctate. Pygidial plate shiny, sparsely punctate. Trochanteral and femoral punctation fine, dense. Length 7.5–9.0 mm.

♂.—Mandibular inner margin with tooth (Fig. 14d). Clypeus (Fig. 14d): bevel equal to basomedian area or much shorter; lip arcuate or sinuate; lip corners rectangular to obtuse, closer to each other than to orbit (ratio: 1:1.3–1.4). Dorsal length of flagellomere I 1.3–1.6 × apical width. Vertex width 1.4–1.9 × width. Sterna densely punctate throughout. Forefemoral notch glabrous. Foretarsus without rake; outer apical spine of foretarsomere II shorter than tarsomere width. Length 5.0–6.5 mm.

DISCUSSION.—According to F. E. Kurczewski (pers. comm.), who obtained his information from J. C. Bradley and E. C. Zimmerman, the three syntypes of *Larra acuta* Patton were destroyed in a fire at the Boston Museum of Natural History around the turn of the century. However, the original diagnosis

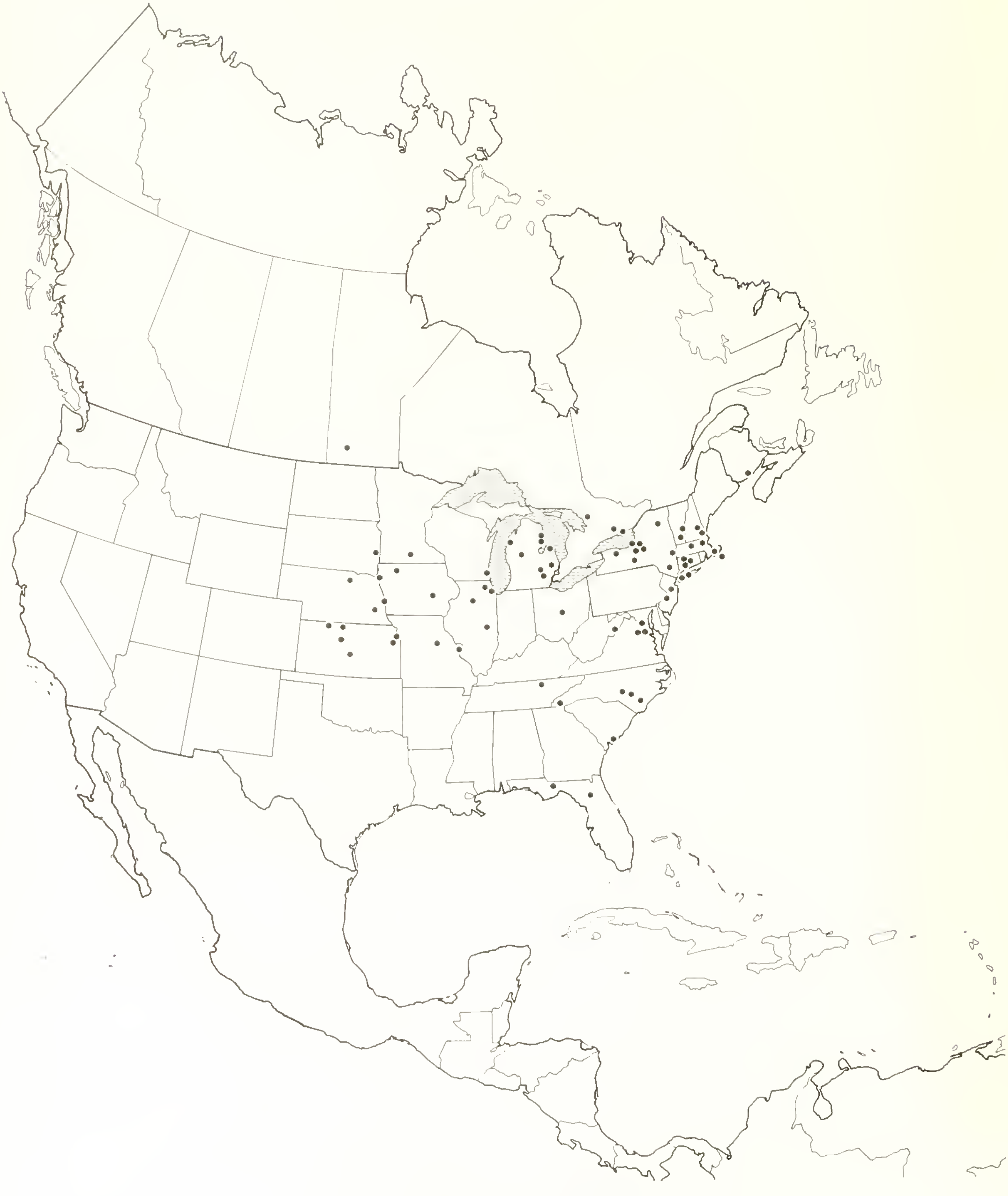

FIGURE 15. Geographic distribution of *Tachysphex acutus* (Patton).

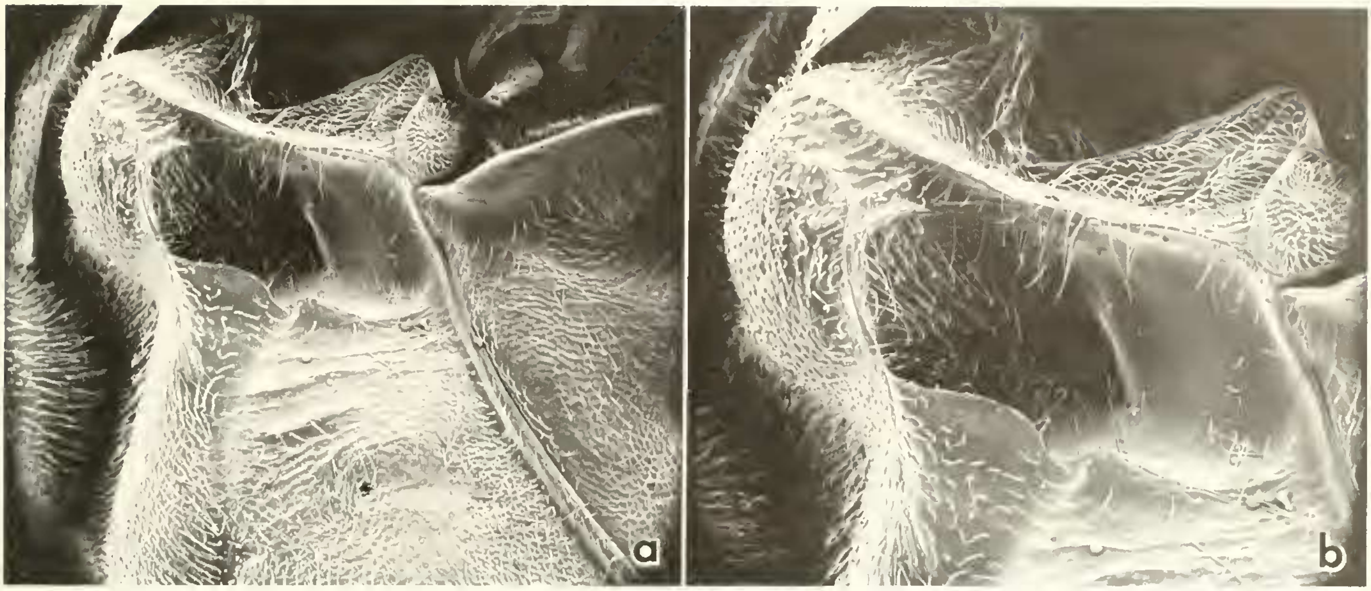

FIGURE 16. *Tachysphex punctifrons* W. Fox, female: a—upper mesopleuron; b—subalar fossa.

agrees rather well with the present species. First, Patton (1881) says that "it is related to *terminata, tarsata* and *montana,*" and this means that it actually is a *Tachysphex*. Second, the black body and silvery fasciate terga I–III noted by Patton are found only in two *Tachysphex* species in New England: *punctifrons* and this species. The body length given by Patton (8–9 mm) excludes *punctifrons*. There is, however a discrepancy between his description and the present species in the sculpture of the propodeal dorsum and side: they are "uniformly and finely granulated" according to Patton, while the side is ridged in all the females studied by me (although ridges are sometimes indistinct). Despite this difference I have designated a neotype that corresponds to the traditional interpretation of *T. acutus*.

LIFE HISTORY.—Robertson's (1928) floral records are unreliable because I suspect he misidentified the species. He recorded *acutus* from flowers of *Chamaecrista fasciculata* (Michx.) Greene (as *Cassia chamaecrista* (L.)), *Ceanothus americanus* L., *Cicuta maculata* L., *Eupatorium perfoliatum* L., *Heracleum lanatum* Michx., *Pycnanthemum flexuosum* (Walt.) B.S.P., and *Solidago canadensis* L.

GEOGRAPHIC DISTRIBUTION (Fig. 15).—North America east of 100th meridian, north to New Brunswick and southern Manitoba, south to northern Florida and Kansas.

MATERIAL EXAMINED.—127♀, 65♂.

RECORDS.—CANADA: **Manitoba:** 5 mi SW Shilo. **New Brunswick:** Nerepis, St. John. **Ontario:** Chatterton, Marmora, Orrville, Sillsville.

UNITED STATES: CONNECTICUT: **Hartford:** Hartford. **Litchfield:** Colebrook. **New Haven:** Waterbury (Patton 1881). DISTRICT OF COLUMBIA: Washington. FLORIDA. **Alachua:** Gainesville. **Gadsden:** Quincy. ILLINOIS: Chicago. **Bureau:** Princetown. **Douglas:** Arcola. **McHenry:** Algonquin. IOWA. **Iowa:** —. **Palo Alto:** Ruthven. **Woodbury:** Sioux City. KANSAS. **Douglas:** Baldwin. **Leavenworth, Norton, Rice:** —. **Riley:** Manhattan. **Russell, Smith:** —. MARYLAND. **Montgomery:** Plummers Island. **Prince Georges:** Beltsville. MASSACHUSETTS: **Barnstable:** Sagamore. **Middlesex:** Bedford near Boston. **Nantucket:** Nantucket. **Worcester:** Petersham. MICHIGAN: **Alcona, Huron, Iosco:** —. **Lapeer:** Deerfield. **Livingston:** E. S. George Reserve. **Manistee, Mecosta:** —. **Washtenaw:** Ann Arbor, Stinchfield Woods. MINNESOTA. **Bluearth:** Mankato. MISSOURI: **Boone:** Columbia. **St. Louis:** St. Louis. NEBRASKA. **Douglas:** Omaha. **Holt:** —. **Lancaster:** Lincoln. NEW HAMPSHIRE. **Belknap:** Alton. **Rockingham:** Nottingham. **Strafford:** Durham. NEW JERSEY: **Burlington:** Riverton. **Mercer:** Princeton. NEW YORK. **Cayuga:** Auburn, Fair Haven, Mount Whiteface near Lake Placid. **Madison:** Chittenango. **Monroe:** Mendon Ponds. **Nassau:** Roslyn. **Oswego:** Mallory, Oswego. **Rensselaer:** Brainard. **Suffolk:** Bohemia. **Tompkins:** Ithaca, McLean. **Ulster:** Cherrytown near Kerhonkson. NORTH CAROLINA. **Cumberland:** Fort Bragg. **Duplin:** Wallace. **Macon:** Highlands. **Moore:** Southern Pines. OHIO. **Franklin:** Columbus. SOUTH CAROLINA. **Charleston:** McClellanville. SOUTH DAKOTA. **Brookings:** Brookings. TENNESSEE. **Morgan:** Burrville. VERMONT. **Windham:** Jamaica. **Windsor:** Hartland. VIRGINIA. **Fairfax:** Falls Church, Glencarlyn, Great Falls. **Stafford:** Stafford. WEST VIRGINIA. **Hardy:** Lost River State Park. WISCONSIN. **Milwaukee:** Milwaukee.

Tachysphex punctifrons (W. Fox)

(Figures 16, 17)

Larra punctifrons W. Fox, 1891:194, ♀.[1] Lectotype: ♀, Montana: no specific locality (USNM), **present designation.**—In *Tachysphex*: W. Fox 1894*a*:531 (♂), Dalla Torre 1897:684, Ashmead 1899:250; J. Smith, 1900:518, 1910:683, H. Smith 1908:380; Mickel 1918:423, Strickland 1947:129; G. Bohart 1951:952, Krombein and Evans 1954:231, Kurczewski 1971:114 (in key); Bohart and Menke 1976:276; Krombein 1979:1629; Kurczewski 1987:118.

Tachysphex fedorensis Rohwer, 1911:576, ♀, ♂.[1] Lectotype: ♀, Texas, Lee Co., Fedor (USNM), **present designation.** Synonymized by G. Bohart 1951:952.

DIAGNOSIS.—The following distinguish *punctifrons* from all other *Tachysphex*: upper mesopleuron longitudinally ridged, subalar fossa unusually deep and carinate below, and postspiracular carina of mesopleuron practically attaining the subalar carina (Fig. 16a, b).

DESCRIPTION.—Punctures less than one diameter apart on frons, subcontiguous on vertex and mesothorax. Mesopleuron longitudinally ridged above (Fig. 16a); subalar fossa carinate below (Fig. 16b), but carina interrupted by episternal sulcus; postspiracular carina much longer than in other species, almost reaching subalar carina; bottom of subalar fossa smooth, shiny, glabrous. Propodeal dorsum uniformly microareolate, side microsculptured, sometimes microridged. Terga densely microsculptured. Hindcoxa not carinate.

Scutal and midfemoral setae appressed, midscutal setae oriented obliquely posterad.

Body black, including legs (tarsal apex reddish in many males). Terga I–III silvery fasciate apically. Wings infumate (moderately so in male), with yellowish tinge.

♀.—Clypeus: bevel shorter to longer than basomedian area; lip incised laterally, usually emarginate mesally. Dorsal length of flagellomere I 2.4–2.8 × apical width. Vertex markedly wider than long. Tergum V densely punctate, including apical depression. Pygidial plate shiny, punctate. Trochanters finely, densely punctate. Forefemoral venter with fine, well-defined, subcontiguous punctures, but a few large punctures. Length 11–14 mm.

Vertex setae suberect, 0.3 MOD long mesally, 0.7 MOD long laterally. Vestiture inconspicuous, not obscuring integument between antennal socket and orbit.

♂.—Clypeus: bevel indistinct, much shorter than basomedian area; lip weakly arcuate, its lateral corners rectangular to obtuse, closer to each other than to orbit. Dorsal length of flagellomere I 1.7–2.1 × apical width. Vertex width 1.9–2.2 × length. Sterna punctate, pubescent, apical depression of sterna II–VI partly glabrous. Foretarsus without rake; outer apical spine of tarsomere II much shorter than tarsomere III. Length 8–13 mm.

Vertex setae erect, 1.0 MOD long anteriorly, several times shorter than MOD posteriorly. Vestiture concealing integument between antennal socket and orbit.

Life History.—Kurczewski (1987) observed nesting and provisioning behavior of *punctifrons* on a moderately vegetated flood plain near Lawrence, Kansas. The female uses her forelegs in unison for digging, and sand accumulates as a tumulus at the burrow entrance. The nest has an oblique gallery and up to six cells; younger cells are closer to the entrance. Juvenile and adult grasshoppers are used as prey: *Melanoplus differentialis* (Thomas) and *Melanoplus* sp. (Kurczewski also mentioned two museum specimens, one from Beltsville, Maryland, in USNM, pinned with a young female nymph of *Melanoplus* sp., probably *bivittatus* (Say), the other from Polk Co., Minnesota, in UCD, pinned with an adult *Melanoplus infantilis* Scudder). The female carries her prey on the ground, holding it with her mandibles by the antennae (near midlength) and clutching the bases of its midcoxae with her hindlegs; the prey is oriented dorsum up. She enters the nest directly, without releasing her load (the description implies that the nest is permanently open during the provisioning period). One or two prey are stored per cell, venter up and head inward. The egg is laid on the largest prey, on the right or left forecoxal corium, and extends transversely between the fore- and midcoxa.

The males from Saint Anthony Sand Dunes, Idaho (UIM), were collected on flowers of *Helianthus annuus* L.

Geographic Distribution (Fig. 17).—North America between East Coast and Alberta, Idaho, northeastern Utah, and central Texas, north to Massachusetts and southern Alberta, south to Florida and central Texas.

Material Examined.—175♀, 197♂.

Records.—CANADA. **Alberta:** Haynes, 12 km SW Orion, Scandia, Writing-on-Stone Provincial Park. **Manitoba:** Aweme, 3 mi SW Shilo, 2 mi W Stockton. **Saskatchewan:** 10 mi W Moose Jaw.

UNITED STATES. COLORADO: **Bent:** Hasty. **Denver:** Denver. **El Paso:** Colorado Springs. **Jefferson:** 4 mi SW Golden. **Larimer:** Fort Collins. CONNECTICUT: **Hartford:** Windsor. FLORIDA: **Alachua:** Alachua, Gainesville, Monteoca (11 mi NW Gainesville). **Baker:** Glen St. Mary. **Bradford:** —. **De Soto:** Arcadia. **Jefferson:** Monticello. **Lafayette:** Day. **Liberty:** Torreya State Park. **Orange:** Orlando. **Suwannee:** Suwannee River State Park. GEORGIA: **De Kalb:** Stone Mt. **Dougherty:** Albany. **Emanuel:** Swainsboro. **Glynn:** St. Simons Islands. **Lee:** Smithville. **Lowndes:** Valdosta. **McIntosh:** Sapelo Island. **Paulding:** Dallas. **Tift:** Tifton. **White:** Cleveland. IDAHO: **Franklin:** S Weston. **Fremont:** 6 mi NW Saint Anthony, Saint Anthony Sand Dunes. ILLINOIS: Chicago. **Mason:** Sand Ridge State Forest. **McHenry:** Algonquin. IOWA: **Woodsbury:** Sioux City. KANSAS: **Douglas:** Lawrence. MARYLAND: **Prince Georges:** Beltsville. MASSACHUSETTS: **Hampshire:** Southampton. **Worcester:** Holden. MICHIGAN: **St. Joseph:** Constantine. MINNESOTA: **Cass:** —. **Clearwater:** Itasca State Park. **Polk:** —. MISSISSIPPI: **Lafayette:** Oxford. MONTANA: —. NEBRASKA: **Cuming:** West Point. **Hooker:** 1.5 mi N Mullen. **Morrill:** Bridgeport. **Scotts Bluff:** Mitchell. **Sheridan:** Rushville. **Sioux:** Glen, Jim Creek, Monroe Canyon. **Thomas:** Halsey. NEW MEXICO: **De Baca:** Sumner Lake State Park. NEW YORK: **Orange:** West Point. **Suffolk:** Riverhead. NORTH CAROLINA: **Cumberland:** Fort Bragg. **Moore:** Southern Pines. NORTH DAKOTA: **Benson:** Hamar. **McHenry:** Towner. **Ransom:** 3 mi N McLeod, Sheldon. **Ward:** Minot. OKLAHOMA: **Cimarron:** Black Mesa State Park. SOUTH DAKOTA: **Union:** Elk Point. TEXAS: **Lee:** Fedor. UTAH: **Cache:** Cornish, Logan. WISCONSIN: **Milwaukee:** Milwaukee. WYOMING: **Fremont:** Shoshoni.

Tachysphex powelli R. Bohart

(Figure 18)

Tachysphex powelli R. Bohart, 1962:35, ♂, ♀. Holotype: ♂, California: Alpine Co.: Winnemucca Lake (CAS).—Krombein 1967:393, Bohart and Menke 1976:276; Krombein 1979:1629.

Diagnosis.—*Tachysphex powelli* has a dull, impunctate mesopleuron (finely rugose in many specimens), the setae are erect on the vertex, erect or nearly so on the mesopleuron, and terga are not fasciate. In the female, the mid- and forefemora are densely punctate (in some specimens also with a few, large punctures basoventrally). In the male, the distance between the clypeal lobe corners is at least equal to the clypeal length, and the forebasitarsus has one to four preapical rake spines. *Tachysphex semirufus* shares these characters, but the setae of the propodeal dorsum are about 1.0 MOD long, erect or nearly so in lateral view. In *powelli*, these setae are about 0.7 MOD long, erect or inclined anterad. Also, the vertex width : length ratio in *powelli* is 1.5–1.7 (female) and 1.6–2.0 (male), while it is 1.1–1.4 (female) and 1.3–1.5 (male) in *semirufus*. The gaster is red in *semirufus*, but it is all black in most *powelli*. Both species occur in cold, sunny habitats, but *powelli* is limited to high altitudes (2,700–3,770 m) of the Sierra Nevada and White Mountains, California, and Ruby Mountains, Nevada, while *semirufus* extends from the Yukon Territory to southern California, and eastward to Ontario, Michigan, and New Jersey (it occurs sympatrically with *powelli* in Sierra Nevada and White Mountains, California).

Description.—Frons punctate or punctatorugose. Vertex and scutum with well-defined punctures, vertex punctures less than one diameter apart. Mesopleuron finely rugose to (some specimens) microareolate. Propodeal dorsum ridged or rugose, at least basally; side rugose, irregularly ridged, or (some specimens) microareolate; hindface usually ridged, but ridges evanescent in some individuals. Sternum I without apical depression. Discal micropuncture of tergum II one to two diameters apart. Hindcoxa not carinate.

Vestiture not obscuring integument between antennal socket and orbit. Setae erect, their length (in MOD): one on vertex and mesopleuron, about 0.5 on scutum; about 0.7 on propodeal dorsum; setae of midfemoral venter appressed, or erect in apical half, about 0.3 MOD long.

Head, thorax, and gaster black, or gaster partly red (see Variation below). Legs black, tarsal apex brown. Terga not fasciate.

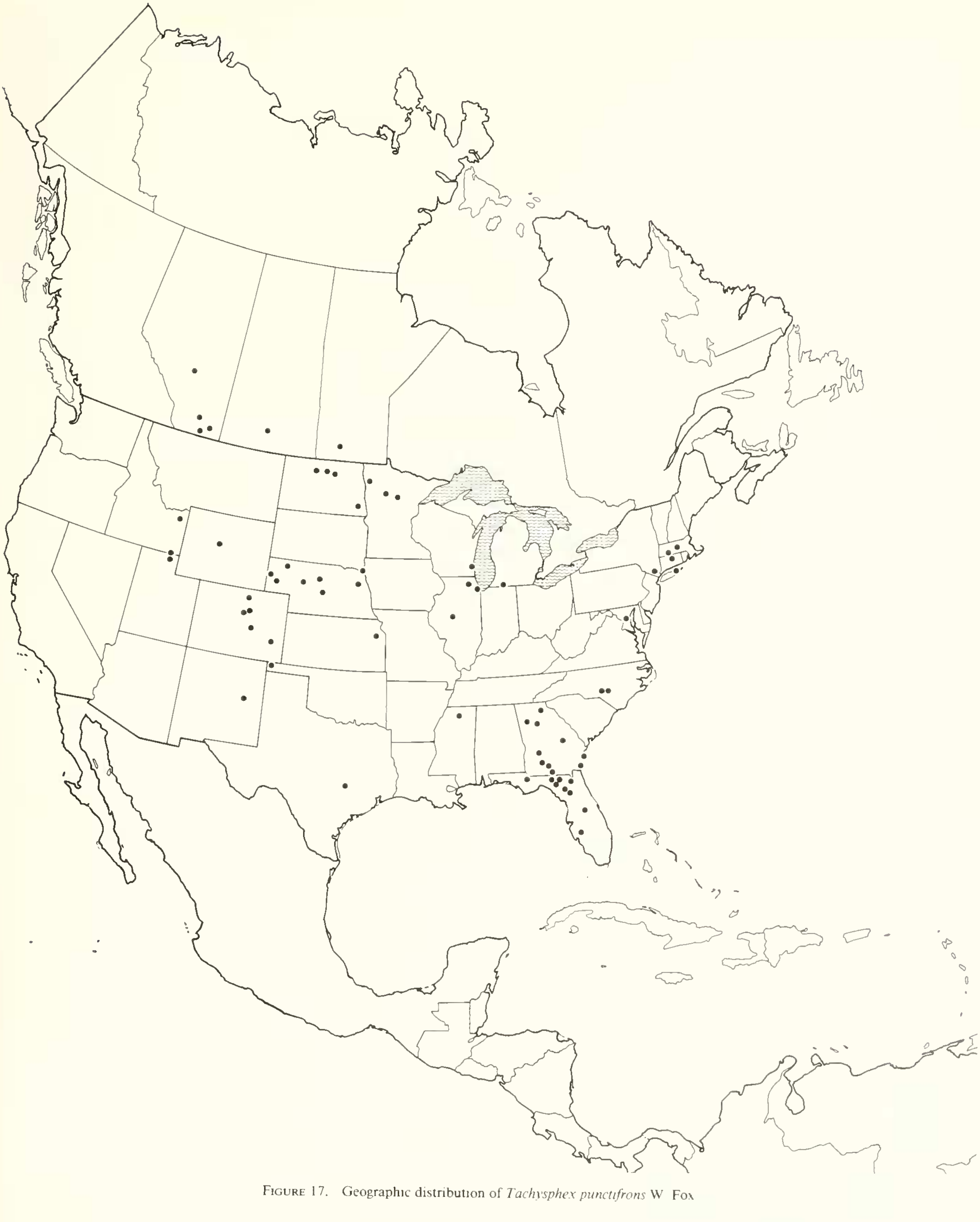

FIGURE 17. Geographic distribution of *Tachysphex punctifrons* W. Fox.

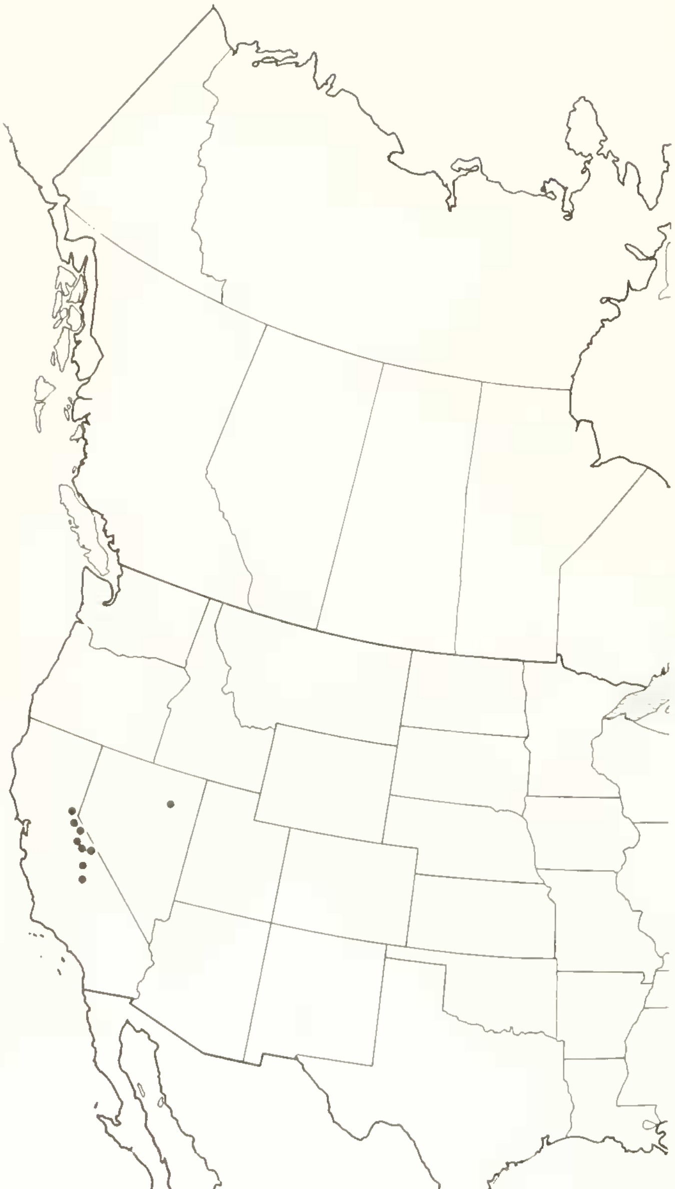

FIGURE 18. Geographic distribution of *Tachysphex powelli* R. Bohart.

Wings strongly infumate in female, weakly to strongly so in male.

♀.—Clypeus: bevel shorter to longer than basomedian area; lip arcuate, entire or (some specimens) shallowly emarginate mesally and incised laterally. Dorsal length of flagellomere I 2.0–2.4× apical width. Vertex width 1.5–1.7× length. Scutal punctures less than one diameter apart or most discal punctures two to three diameters apart. Tergum V densely to sparsely punctate (punctures evanescent in some specimens), its apical depression impunctate. Pygidial plate shiny, punctate. Trochanteral and femoral punctation dense. Length 7.5–11.0 mm.

♂.—Mandibular inner margin with tooth. Clypeus: bevel shorter than basomedian area; lip arcuate or truncate, its corners rectangular to obtuse, separated by a distance equal to 1.1–1.4 of clypeal length and to 1.0–1.3 of distance between a corner and orbit. Dorsal length of flagellomere I 1.1–1.3× apical width. Vertex width 1.6–2.0× length. Scutal punctures subcontiguous or (some specimens) many discal punctures one to two diameters apart. Sterna densely punctate. Forefemoral notch glabrous, margined posteriorly in many specimens. Forebasitarsus with one to three preapical rake spines; outer apical spine of foretarsomere II longer than tarsomere width. Length 6.5–9.0 mm.

VARIATION.—The gaster is all black in most specimens, but it is partly red in some individuals. Of the two females from Blue Canyon near Sonora Pass collected on 10 August 1960 by J. W. MacSwain (CAS), one is all black and the other has terga I–III and a large part of sternum II dark red. Otherwise these two individuals are identical. Most females from Sonora Pass are all black, but one female examined (UCD) has largely red terga I–III. Unlike other males examined, the holotype of *powelli* has a reddish dark apicomedian zone on tergum II.

GEOGRAPHIC DISTRIBUTION (Fig. 18).—Sierra Nevada and White Mountains in California, and also Ruby Mountains in Nevada, at the elevation 2,700–3,770 m (7,800–12,400 ft).

MATERIAL EXAMINED.—53♀, 62♂ (CAS, CIS, CSDA, SDNH, TLG, UCD, USNM).

RECORDS.—UNITED STATES: CALIFORNIA: **Alpine:** Ebbetts Pass, Winnemucca Lake. **El Dorado:** Strawberry Lake. **Fresno:** Heart Lake, Horseshoe Lakes, Humphreys Basin (14 mi SW Bishop), Nellie Lake (R. Bohart 1962), Pioneer Basin (10–11,000 ft). **Inyo:** Campito Mountain (White Mts.), Mono Pass, Rock Creek Lakes (9,700 ft), Ruby Lake. **Mono:** Mammoth Lake, Sonora Pass, 1 mi W Tom's Place, White Mts. (9 air mi N Inyo Co. line, Patriarch Grove, Sheep Mt.). **Nevada:** Mt. Lola (8 mi NE Soda Springs). **Tulare:** Kings Canyon National Park (Muir Trail 12,300 ft, above Lake 12,248 ft—headwaters of Bubbs Creek), Mineral King, Mosquito Lakes, Sequoia National Park (Muir Trail 2–3 mi S Forester Pass, 1.5 mi S Lake South America, Tyndall Creek). **Tuolumne:** Sonora Pass, Sonora Peak, Tioga Pass, Tuolumne Meadows, Upper Gaylor Lake near Tioga Pass. NEVADA: **Elko:** below Liberty Lake in Ruby Mts. (1♂, CAS).

Tachysphex semirufus (Cresson)

(Figures 19, 20)

Larrada semirufa Cresson, 1865:464, ♀, ♂. Lectotype: ♀, Colorado: no specific locality (ANSP), designated by Cresson 1916:96.—Riley 1878:317.—In *Larra*: Patton 1881:389, Ashmead 1890:33.—In *Tachysphex*: Ashmead 1894:63, W. Fox 1894*a*:515, Dalla Torre 1897:685, Ashmead 1899:25, Rohwer 1911:580 (in key), Mickel 1918:422, G. Bohart 1951:952, Krombein 1967:393; Bohart and Menke 1976:276, Krombein 1979:1629, Kurczewski and Evans, 1986:721.

Tachysphex punctulatus H. Smith, 1906:246, ♀, ♂. Holotype: ♀, Nebraska: Sioux Co.: no specific locality (UNL). Nec Kohl, 1884. Synonymized by G. Bohart 1951:952.—Rohwer 1911:580 (in key).

Tachysphex puncticeps H. Smith, 1908:381 (new name for *Tachysphex punctulatus* H. Smith, 1906, nec Kohl, 1884). Nec Cameron, 1903. Synonymized by G. Bohart 1951:952.—Mickel 1918:424.

Tachysphex giffardi Rohwer, 1917*b*:244, ♀. Holotype: ♀, California: Placer Co.: Summit (USNM). Synonymized by G. Bohart 1951:952.

DIAGNOSIS.—*Tachysphex semirufus* has a dull, uniformly microareolate mesopleuron (Fig. 19b); nonfasciate terga; setae 1.0 MOD long and erect on the vertex and propodeal dorsum in

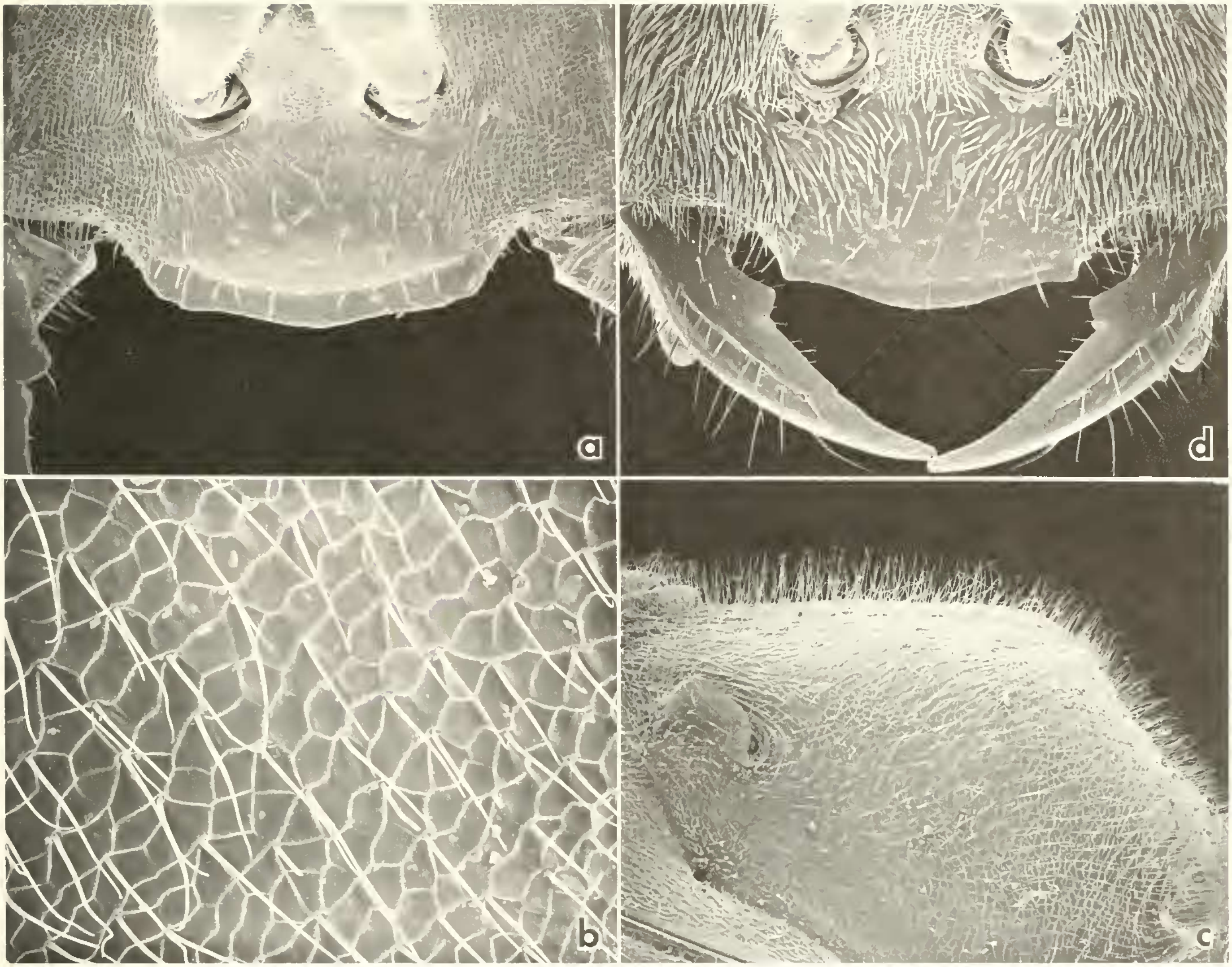

FIGURE 19. *Tachysphex semirufus* (Cresson): a—female clypeus, b—mesopleural sculpture of female; c—female propodeum, lateral view; d—male clypeus.

lateral view (Fig. 19c), 1.0 MOD long and erect or slightly inclined on the mesopleuron; and the male forebasitarsus with three or four preapical rake spines. *Tachysphex powelli* and *tahoe* are similar (see these species for differences). *Tachysphex mirandus* is also similar, but *semirufus* differs in having the femoral venter densely micropunctate, the mesothoracic venter densely punctate, the male clypeal lobe nontriangular, and the male mandible with a tooth on the inner margin (Fig. 19d). In *mirandus*, the female fore- and midfemur basoventrally have sparse punctures but no micropunctation (Fig. 71b), the male clypeal lobe is triangular, the inner mandibular margin is not dentate (Fig. 71c), and the mesothoracic venter of most specimens (both sexes) is sparsely punctate.

DESCRIPTION.—Frons dull, its punctures shallow, in most specimens less than one diameter apart. Vertex punctures more than one diameter apart, but less than that in some males. Mesopleuron dull, impunctate, evenly microareolate (Fig. 19b). Propodeal dorsum evenly microareolate; side microareolate or microridged; hindface ridged or uniformly microsculptured (especially in males). Sternum I without apical depression. Hindcoxa not carinate.

Vestiture not obscuring integument between antennal socket and orbit. Setae erect or suberect, 1.0 MOD long on vertex, mesopleuron, and propodeal dorsum (Fig. 19c); 0.3–0.5 MOD long on scutum, at middle inclined evenly posterad. Apical half of midfemoral venter with erect or suberect setae that are 0.5–1.0 MOD long.

Head, thorax, and legs black, tarsal apex reddish. Gaster usually red, but terga III–VI black in a female from Glendo, Wyoming, and terga I and IV–VII black in some males from British Columbia and Saskatchewan. Terga not fasciate. Wings infumate, often with violet reflection, but almost hyaline in many males. Frontal vestiture silvery.

♀.– Clypeus (Fig. 19a): bevel much longer than basomedian area; lip arcuate, not emarginate, usually with short, obtuse projection mesally, incised laterally in some specimens. Dorsal length of flagellomere I 2.4–3.0× apical width. Vertex width 1.1–1.4× length. Scutal punctures subcontiguous to many diameters apart at middle (usually two to three diameters apart). Tergal microsculpture fine, variably developed, sometimes almost absent (and then the integument is highly polished); micropuntures of tergum II two or three to many diameters apart. Tergum V impunctate or with a few, sparse punctures; its apical depression impunctate. Pygidial plate smooth or alutaceous, punctate. Trochanteral punctures minute, dense to sparse on venter. Punctures of forefemoral venter minute, usually sparse basally. Length 6–11 mm.

♂.—Mandibular inner margin with tooth (Fig. 19d). Clypeus (Fig. 19d): bevel indistinctly delimited posteriorly, about as long as basomedian area; lip evenly arcuate, its corners obtuse, closer to orbit than to each other; a small, longitudinal carina extends from each lip corner. Dorsal length of flagellomere I 1.3–1.8 × apical width. Vertex width 1.3–1.5 × length. Scutal punctures subcontiguous. Micropunctures of tergum II two to three diameters apart at middle. Sternal punctures fine, dense, except for impunctate apical depression of sterna II–V. Forefemoral notch glabrous. Foretarsus with three or four preapical rake spines; outer apical spine of foretarsomere II equal to tarsomere III or longer. Length 5–6 mm.

Life History.—Riley (1878) reported that *semirufus* preyed on young nymphs of the Rocky Mountain grasshopper, *Melanoplus spretus* (Walsh), but his identification of the wasp is not certain. Krombein (1967) also lists immature *Melanoplus* as prey of this species, but his information is probably based on Riley (1878). H. Smith's (1908) record of *semirufus* visiting flowers of *Astragalus* is also questionable. Kurczewski and Evans (1986) described the provisioning behavior of a female in Jackson Hole, Wyoming: the wasp proceeded forward on the ground, holding her prey with the mandibles by the base of its antennae. She entered an open nest, deposited the prey, and started closing the burrow using material from the tumulus. The burrow entered the soil obliquely and ended in a single cell that contained a single prey, a nymphal mormon cricket *Anabrus simplex* Haldemann (Tettigoniidae). A female of *semirufus* from Santa Clara, Utah (USU) is pinned with her prey, also a young tettigoniid, a *Capnobates* sp., probably *occidentalis* (Thomas), det. D. C. F. Rentz.

Geographic Distribution (Fig. 20).—Montane areas between Yukon Territory, southern California and Arizona, east to Colorado and western Nebraska; also southern Ontario, New Jersey, and Michigan.

Material Examined.—290♀, 63♂.

Records.—CANADA: **Alberta:** 5 mi W Smith, Wamamun. **British Columbia:** Blueberry, Nicola, Osoyoos. **Ontario:** Constance Bay, Merivale near Ottawa. **Saskatchewan:** Great Sand Hills, Landing, Rosthern. **Yukon Territory:** Whitehorse.

UNITED STATES: ARIZONA: **Cochise:** Huachuca Mts. **Coconino:** Grand Canyon National Park. CALIFORNIA: **Alameda:** Tesla Road. **Alpine. Amador:** Fiddletown. **El Dorado. Fresno:** 3 mi E Redinger Lake. **Glenn:** Black Butte, Plaskett Meadows. **Inyo:** Mono Pass (ca. 10 mi S Tom's Place, near county line). **Kern:** Walker Pass. **Kings:** 6 mi SW Avenal. **Lassen:** Doyle, Susanville. **Los Angeles:** Bell Canyon, Little Rock, Pasadena, San Gabriel Canyon, 6 mi NE Three Points. **Modoc. Mono:** McGee Creek (8 mi W Tom's Place), Sardine Creek, White Mts. (Blanco's Corral, Crooked Creek). **Monterey:** Chews Ridge near White Oak Camp, Pacific Grove. **Napa:** 6 mi W Oakville. **Nevada:** Donner Lake, Prosser Dam, Sagehen Creek near Hobart Mills. **Placer:** Carnelian Bay on Lake Tahoe, Summit. **Plumas:** Bucks Lake, 10 mi S Johnsville. **Riverside:** Lake Fulmor. **San Bernardino:** 4 mi NW Crestline, 5 mi N Vidal Junction. **San Diego:** Borrego, Julian, Lake Wohlford, Pottero. **San Luis Obispo:** Cuyama Valley. **Santa Barbara:** New Cuyama (also 10 mi W). **Shasta:** Lassen Peak trail, 3 mi SE Mt. Lassen. **Sierra:** Packer Creek. **Siskiyou:** Dry Lake Lookout (7 mi NNW town of Klamath River), Mt. Shasta (6,000 ft), Walker. **Trinity:** Buttercreek Meadow, Covington Mill, Hayfork Bally. **Tulare:** Bear Creek (5 mi NE Springville), Quaking Aspen, Sequoia National Park. **Tuolumne. Ventura:** Mt. Pinos (7,500–8,800 ft). **Yolo:** Rumsey. COLORADO: **Alamosa:** Great Sand Dunes National Monument. **Boulder:** Nederland. **Clear Creek:** Mount Evans (elev. 11,600 ft). **Costilla:** Ute Creek. **Denver:** Denver. **Gunnison:** 3 mi N Gothic. **Jackson:** Walden. **Jefferson:** Platte Canyon. **Larimer:** Camp Creek Ranger Station (about 41°0'N, 106°12'W), Fort Collins. IDAHO: **Bear Lake:** Bloomington Lake. **Clearwater:** Beaver Ridge. **Gooding:** 5 mi N Bliss. **Lemhi:** Bannock Pass, Meadow Lake (6 mi W Gilmore). **Lincoln:** Dietrich Butte, Owynza. **Minidoka:** Minidoka. **Twin Falls:** Rock Creek Canyon. MICHIGAN: **Alger:** Pictured Rocks National Lakeshore. **Benzie:** Sleeping Bear Dunes. **Clare:** —. **Livingston:** E. S. George Reserve. **Marquette:** Huron Mountain Club. **Osceola:** Tustin. NEBRASKA: **Sioux:** Monroe Canyon. NEVADA: **Clark:** Boulder Dam. **Elko:** Harrison Pass, Lamoille Canyon (Ruby Mts.). **Humboldt:** Winnemucca. **Lander:** Kingston Canyon. **Pershing:** 40 mi NW Lovelock. **Washoe:** Galena Creek, Incline Village, Mt. Rose, Steamboat. NEW JERSEY: **Burlington:** Browns Mills Junction (1♀, UCD). **Camden:** Clementon (1♀, UCD). OREGON: **Clackamas:** Mt. Hood (timberline near Government's Camp). **Klamath:** Aspen Lake, Eagle Ridge on Klamath Lake, Klamath Falls, Sun Pass. **Lake:** Abert Lake. UTAH: **Box Elder:** Promontory Point. **Cache:** Cache National Forest, Tony Grove. **Millard:** 8 mi W Hatton. **Washington:** Santa Clara. **Weber:** Willard Peak. WASHINGTON: **Benton:** 2 mi W Wallula Junction. **Walla Walla:** McNary Natural Wildlife Refuge. WYOMING: **Fremont:** Chimney Rock Peak (Wind River Range). **Hot Springs:** Thermopolis. **Laramie:** Cheyenne. **Lincoln:** Kemmerer. **Platte:** Glendo, Guernsey. **Sweetwater:** Green River. **Teton.**

Tachysphex pauxillus W. Fox

(Figures 21, 22)

Tachysphex pauxillus W. Fox, 1894*a*:530, ♀.[1] Holotype: ♀, California: no specific locality (ANSP).—Dalla Torre 1897:683, Ashmead 1899:250, Cresson 1928:45, G. Bohart 1951:951, Bohart and Menke 1976:275, Krombein 1979:1629; Rust et al. 1985:46, Kurczewski and Evans 1986:720.

Tachysphex nigrior W. Fox, 1894*a*:530, ♀, ♂.[1] Lectotype: ♀, State of Washington: no specific locality (ANSP), designated by Cresson 1928:45. Synonymized by Pulawski *in* Krombein 1979:1629.—Dalla Torre 1897:681, Ashmead 1899:250; G. Bohart 1951:951, Krombein 1967:393, Evans 1970:490, 497, Bohart and Menke 1976:275.

Diagnosis.—*Tachysphex pauxillus* has a distinctive mesothoracic sculpture (Fig. 21c): the mesopleuron is alutaceous, with inconspicuous vestiture and minute punctures that are one (some males) to many diameters apart. In addition, many punctures of the scutal disk are more than one diameter apart in nearly all females and most males. The thick gena in dorsal view (Fig. 21b, e) is a subsidiary recognition character.

Description.—Frons strongly microsculptured, finely punctate, most punctures less than one diameter apart or (some specimens) more than one diameter apart. Vertex alutaceous, finely punctate, punctures at middle less than one to several diameters apart. Mesopleuron alutaceous, finely punctate (Fig. 21c). Propodeal dorsum irregularly rugose or evenly microareolate; side and hindface ridged (ridges evanescent in some specimens). Sternum I without apical depression. Hindcoxa not carinate.

Frontal vestiture weak, integument easily visible between antennal socket and orbit. Midscutal setae oriented posterad. Midfemoral venter almost glabrous.

Body black or gastral terga I–III and sternum II red (all black males are more common than all black females); tarsal apex brownish. Terga not fasciate or terga II and III of some males with inconspicuous, silvery fascia. Frontal vestiture silvery. Wings infumate, only weakly so in some males.

♀.—Clypeus (Fig. 21a): bevel much longer to a little shorter than basomedian area; lip almost straight, in most specimens shallowly incised laterally. Dorsal length of flagellomere I 1.4–2.0 × apical width. Vertex width 1.6–1.8 × length. Scutum shiny (except anteriorly), its punctures fine, averaging several diam-

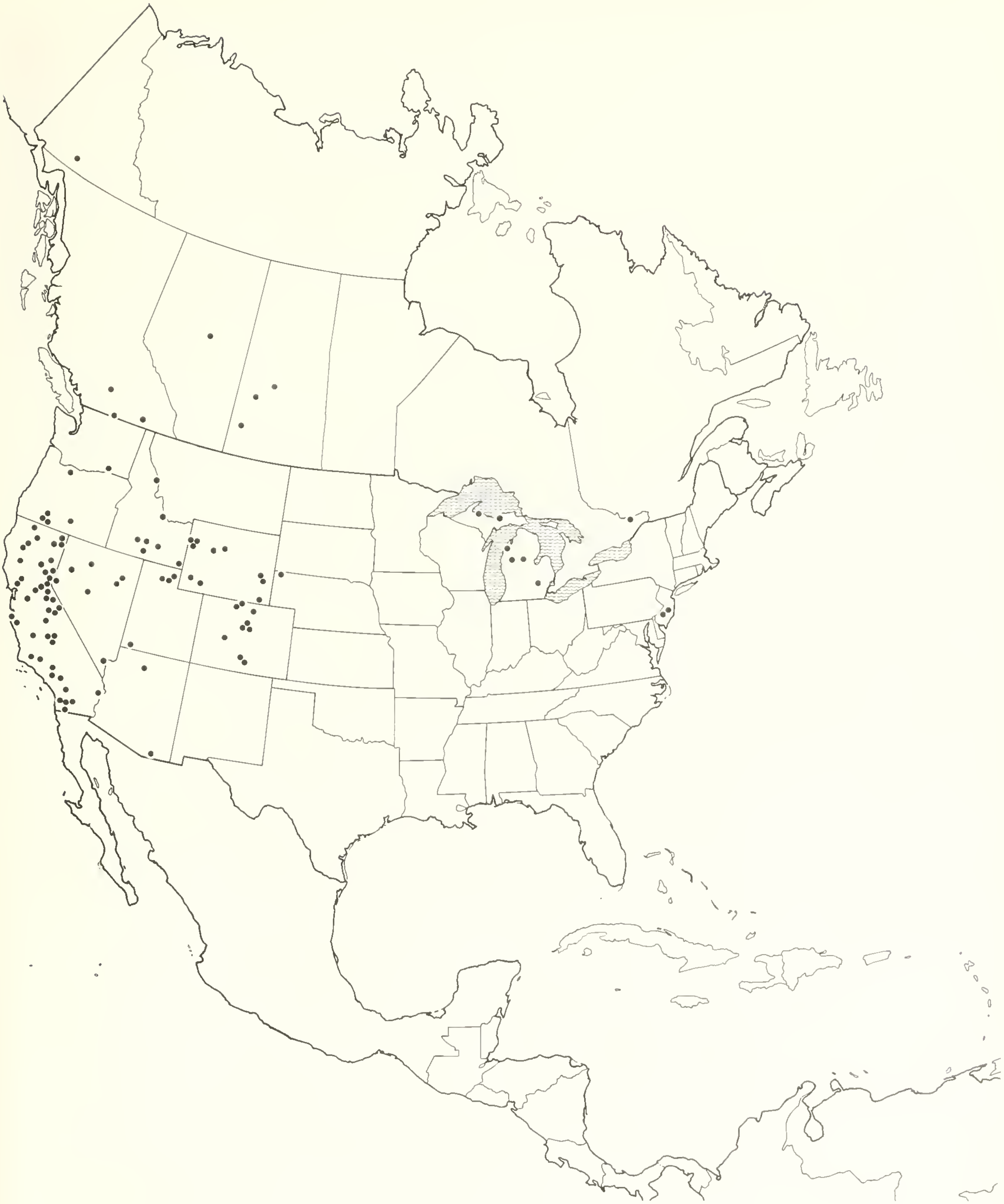

FIGURE 20. Geographic distribution of *Tachysphex semirufus* (Cresson).

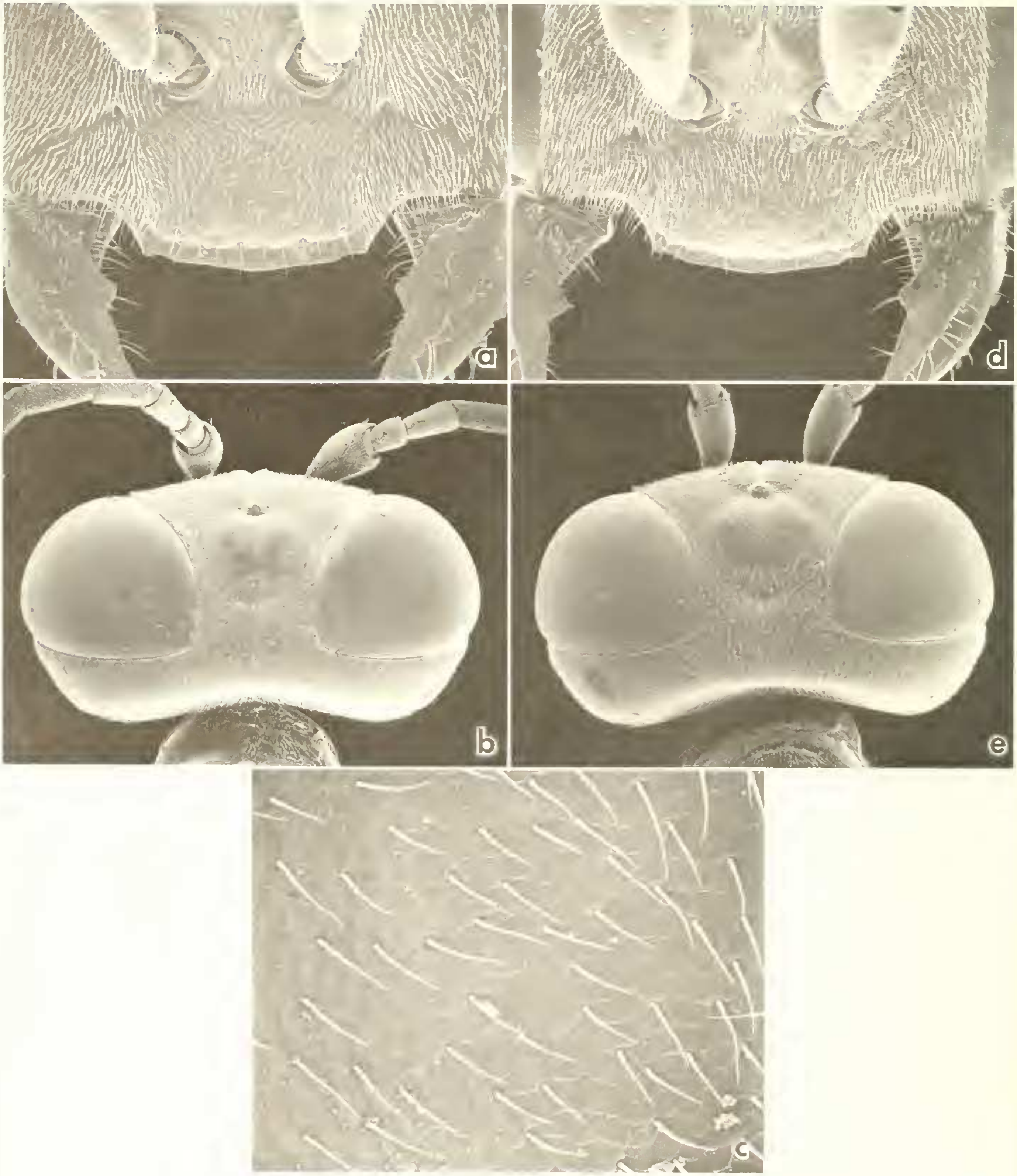

FIGURE 21. *Tachysphex pauxillus* W. Fox. a—female clypeus; b—female head from above; c—mesopleural sculpture of female; d—male clypeus; e—male head from above.

eters apart, but less than one diameter apart in some specimens. Mesopleural punctures inconspicuous, evanescent in some individuals, two to several diameters apart. Micropunctures of tergum I (except basally) and II several diameters apart. Tergum V sparsely punctate. Trochanteral punctures mostly dense, but sparse on venter in some specimens. Forefemoral venter alutaceous, finely punctate (punctures sparse, at least at middle). Length 6–9 mm.

Vertex setae erect, 1.0 MOD long anteriorly, subappressed posteriorly. Scutal setae sparse, erect or suberect, slightly shorter than MOD.

♂.—Mandibular inner margin with tooth (Fig. 21d). Clypeus (Fig. 21d): bevel about as long as basomedian area; lip weakly arcuate, its corners obtuse, closer to orbits than to each other. Dorsal length of flagellomere I 0.9–1.1× apical width. Vertex width 1.8–2.2× length. Scutum shiny, finely punctate, discal punctures often averaging more than one diameter apart. Mesopleural punctures shallow, in most specimens inconspicuous, one to many diameters apart. Discal micropunctures of tergum II two to four diameters apart. Sterna densely punctate throughout. Forefemoral notch pruinose. Foretarsus without rake; outer apical spine of tarsomere II much shorter than III. Length 5–8 mm.

Vertex setae erect at least anteriorly, 0.5–0.7 MOD long. Scutal setae suberect, about 0.5 MOD long.

LIFE HISTORY.—Two females examined (USU) were collected on flowers of *Daucus carota* L. in Logan, Utah. Evans (1970, as *nigrior*) observed a female transporting her prey, a grasshopper, which she was holding by the antennae with her mandibles. Her nest was open and had a small mound of sand at the entrance. Before leaving, she closed the entrance. The shallow cell contained one prey, with egg laid transversely behind the front coxae. The grasshopper was an immature *Melanoplus* sp., about the same size as the wasp.

Evans (1970) found two males of *pauxillus* among the prey of *Philanthus pulcher* Dalla Torre.

GEOGRAPHIC DISTRIBUTION (Fig. 22).—Montane areas between southern British Columbia and southern California, east to Colorado and Nebraska (unknown from the Great Basin area).

MATERIAL EXAMINED.—214♀, 155♂.

RECORDS (b: gaster all or predominantly black, r: gaster red basally).—CANADA: **British Columbia:** Richter Pass Road 8 mi W Osoyoos (b).

UNITED STATES: CALIFORNIA: **Alameda:** 1 mi E Mission Peak (b, r). **Contra Costa:** Castle Rock (b), Mt. Diablo (b, r), Las Trampas Ridge W Danville (b). **El Dorado:** Bijou (b), Blodgett Forest 13 mi E Georgetown (r), Fallen Leaf Lake (b), 8 mi N on Ice House Road (b), Meyers (b). **Fresno:** Mendota (r), Panoche Road (r). **Glenn:** Artois (b). **Lake:** Middleton (r). **Lassen:** Norvell (r). **Marin:** Olema (r), Mt. Tamalpais State Park (b, r). **Mendocino:** Hopland Field Station (b, r), Inglenook Fen 0.5 mi N Fort Bragg (b, r). **Modoc:** 8 mi N Adin (r), 6 mi NW Cedarville (b). **Mono:** White Mts., Patriarch Grove (r). **Monterey:** Bryson (r). **Napa:** Angwin (r). **Nevada:** Independence Lake (b), Sagehen Creek near Hobart Mills (b, r). **Placer:** Baxter (b), Carnelian Bay on Lake Tahoe (b, r), Dutch Flat (b, r), 4 mi S Rocklin (r). **Plumas:** Buck's Lake (b, r), Johnsville (b). **Riverside:** Herkey Creek in San Jacinto Mts. (r). **Sacramento:** Sacramento (r). **San Diego:** Alpine (b). **San Francisco:** Presidio Park (b, r). **San Mateo:** Menlo Park (b, r). **Santa Barbara:** Santa Cruz Island (Christi Beach: r, Prisoner's Harbor: r), Santa Rosa Island (Beechers Bay: r; Windmill Canyon North Fork: b, r). **Shasta:** Shingletown (b). **Sierra:** Independence Lake (b, r), Sierra Valley (b), Sierraville (r), Yuba Pass (b, r). **Siskiyou:** Dry Lake Mountain 7 mi NNW town of Klamath River (b, r). **Stanislaus:** 3.2 mi W Highway 120 on Evergreen road (r). **Trinity:** Hayfork (r), Scott Mt. (r). **Tuolumne:** Dodge Ridge Ski Area (b), Mather (b, r). **Yolo:** Davis (r). COLORADO: **Clear Creek:** Mt. Evans, 12,000 ft (b). **Larimer:** Tundra Curves in Rocky Mountains National Park. IDAHO: **Bear Lake:** Georgetown (b). **Boise:** 1 mi W Horseshoe Bend (b). **Clearwater:** Elk River (b), 10 mi N Nez Perce (b). **Custer:** Sawtooth Lake (b). **Elmore:** Dixie (b). **Franklin:** Cub River Canyon (b), Minkcreek (b). **Latah:** 4 mi N Moscow (also 7 mi NE, b), Moscow Mt. (b), Upper Palouse River (b). MONTANA: **Beaverhead:** 3 mi W Jackson (b). **Ravalli:** Ham-

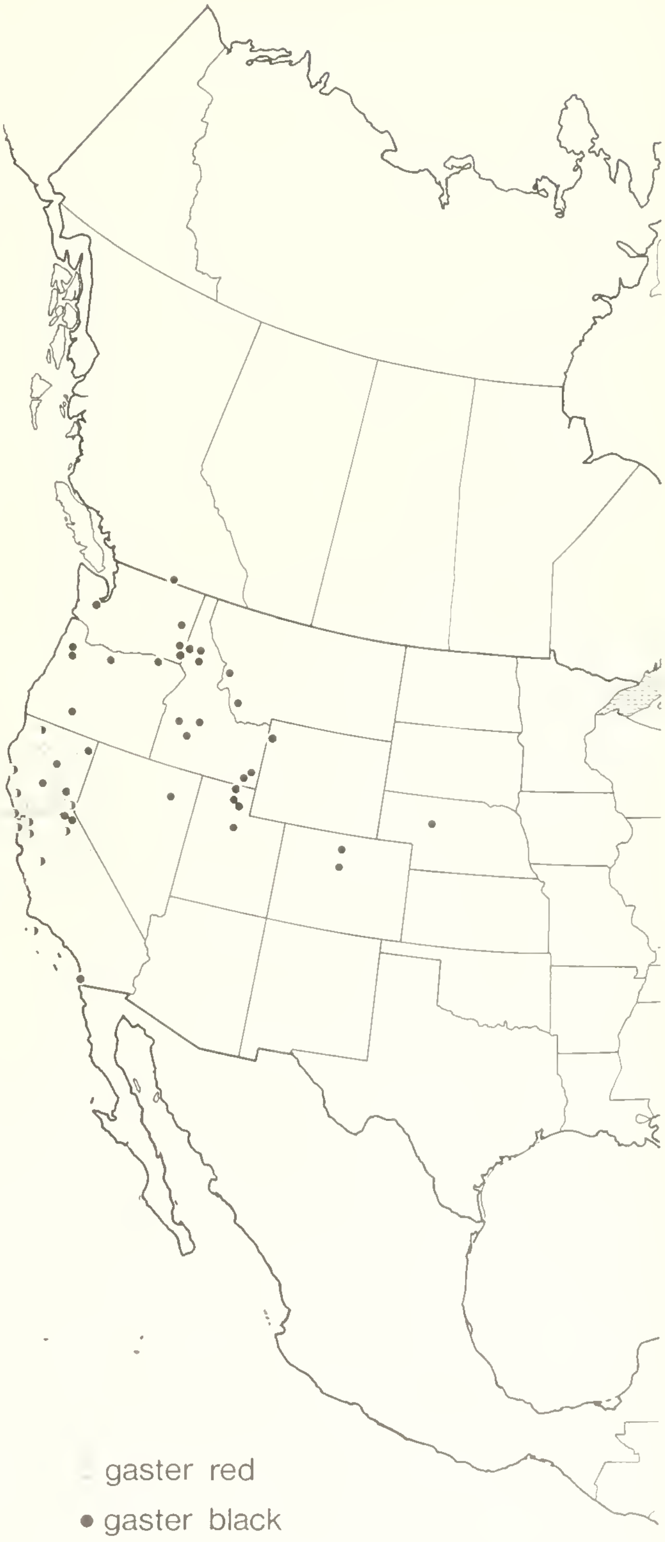

FIGURE 22. Geographic distribution of *Tachysphex pauxillus* W. Fox.

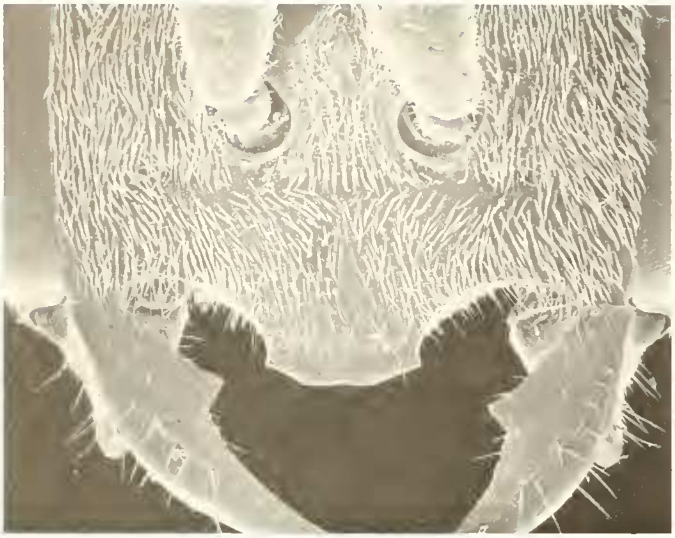

FIGURE 23. *Tachysphex eldoradensis* Rohwer: a—male clypeus.

ilton (b). NEBRASKA: **Hooker:** 1.5 mi N Mullen (b). NEVADA: **Elko:** Ruby Mts (b) (Favre Lake, Island Lake, Lamoille Canyon, Liberty Lake). OREGON: **Benton:** Adair (b). **Klamath:** Upper Klamath Marsh (b). **Marion:** Salem (b). **Umatilla:** Milton–Freewater (b). **Wasco:** 5 mi S Dufur (b). UTAH: **Cache:** Airport (b), Benson Ward (b), Blacksmith Fork (b), High Creek (b), Logan (b), Logan Canyon (b), Newton (b), River Heights (b), Sardine Canyon (b), Wellsville (b), Willard Peak (b). **Utah:** Provo (b). **Weber:** Ogden (b). WASHINGTON: **Asotin:** Asotin (b). **Spokane:** Medical Lake (b), Tyler (b). **Thurston:** Olympia (b). **Walla Walla:** Mill Creek (b). **Whitman:** Almota (b), Pullman (b). WYOMING: **Teton:** Pilgrim Creek in Teton National Forest (b), Moran (b).

Tachysphex eldoradensis Rohwer

(Figures 23, 24)

Tachysphex eldoradensis Rohwer, 1917*b*:245, ♀, ♂. Holotype ♀, California, El Dorado Co.: Tahoe (USNM).—G. Bohart 1951:951. Krombein 1967:393. Bohart and Menke 1976:273. Krombein 1979:1628.

DIAGNOSIS.—*Tachysphex eldoradensis* has a dull, indistinctly punctate mesopleuron (weakly rugose in some individuals). The female can be recognized by its shiny, sparsely punctate trochanteral venter, its broad vertex (vertex width 1.4–1.9 × length), and by its large size (body length 9.0–10.5 mm). Several other species (*aethiops*, *crenulatus*, *irregularis*, *musciventris*, and *orestes*) also have a sparsely punctate trochanteral venter, but they have unique characters that are absent in *eldoradensis* (see these species for details).

Males of *eldoradensis* have an unusually narrow but prominent clypeal lobe (Fig. 23): the lip corners are much closer to each other than to orbit and the distance between the corners equals 0.45–0.7 of clypeal length. In addition, the foretarsal rake is well developed, and the propodeal side is not ridged. Males of *hopi* are similar, but in *eladoradensis* punctures are finer on sterna than on the mesothoracic venter and extend to the sternal hindmargin, and in most specimens the trochanteral venter is impunctate or sparsely punctate. In *hopi*, punctures are slightly coarser on the sterna than on the mesothoracic venter, sterna II–IV of most specimens have a narrow impunctate zone apically (or only apicolaterally), and the trochanters are densely, finely punctate. Altitudinal distribution also helps identification: *eldoradensis* occurs between 900 m (e.g., in Siskiyou County, California) and 3,300 m in the White Mountains, California, while *hopi* is a low elevation species (almost sea level in Marin County, California to 1,800 m near Strawberry, Tuolumne County, California). Because of its narrow clypeal lobe, the male of *eldoradensis* can also be confused with *occidentalis* and *bohartorum*. However, its clypeal lip is angulate, and the mandibular inner margin has a tooth (in *occidentalis*, the clypeal lip is rounded laterally, and the mandibular inner margin is not dentate). Males of *bohartorum* have a distinctive gastral punctation (see that species for details).

DESCRIPTION.—Punctures less than one diameter apart on frons, vertex, and scutum. Mesopleuron dull, densely, shallowly, indistinctly punctate, weakly rugose in some specimens. Propodeal dorsum evenly microreticulate, side at most (in large females) with vestigial ridges; hindface ridged, only weakly so in some individuals. Discal micropunctures of tergum II two to three diameters apart. Sternum I without apical depression. Hindcoxa not carinate.

Vestiture almost totally hiding integument between antennal socket and orbit. Scutal and femoral setae appressed.

Head, thorax, and legs black, tarsal apex reddish. Gaster red (only three basal segments in specimens from British Columbia and Montana, the remainder being black). Wings moderately infumate. Frontal vestiture silvery.

♀.—Clypeus: bevel shorter to longer than basomedian area; lip weakly arcuate, with one shallow, lateral incision on each side, in some specimens also with vestigial, mesal notch. Dorsal length of flagellomere I 2.1–2.4 × apical width. Vertex width 1.4–1.9 × length. Tergum V densely punctate, but apical depression impunctate in some specimens. Pygidial plate alutaceous, punctate. Trochanteral venter shiny, with few, sparse punctures. Punctures of femoral venter fine, dense, but in some individuals basally sparse. Length 9.0–10.5 mm.

Postocellar impression with erect setae whose length is almost 1.0 MOD.

Terga I–IV at most weakly silvery fasciate apically (fasciae inconspicuous or absent).

♂.—Mandibular inner margin with tooth (Fig. 23). Clypeus (Fig. 23): bevel indistinctly delimited posteriorly, shorter to longer than basomedian area; lip arcuate, with obtuse corners; distance between corners equal to 0.6–0.7 of clypeal length and also of distance between corner and orbit. Dorsal length of flagellomere I 1.0–1.3 × apical width. Vertex width 1.6–1.7 × length. Sterna densely punctate throughout, punctures finer than on mesothoracic venter. Trochanteral venter shiny, sparsely punctate (most specimens), or with dense punctures (e.g., in a male from Dodge Ridge Ski Area, California, whose sternal punctures are as in remaining *eldoradensis*). Forefemoral notch marginate, glabrous. Forebasitarsus with three or four preapical rake spines; outer apical spine of foretarsomere II as long as foretarsomere III or longer. Length 6–8 mm.

Vertex setae erect, as long as MOD on postocellar impression.

Terga I–III silvery fasciate apically (certain specimens) or fasciae absent.

GEOGRAPHIC DISTRIBUTION (Fig. 24).—California (mainly Sierra Nevada) to Washington and Montana, east to Wyoming and Colorado.

MATERIAL EXAMINED.—56♀, 67♂ (CAS, CIS, CSDA, CSU, KU, NSDA, NYSU, UCD, UIM, USNM, USU, WJP, WSU).

RECORDS.—UNITED STATES: CALIFORNIA: **Alpine:** Hope Valley, Winnemucca Lake. **El Dorado:** Desolation Valley Primitive Area, Meyers, Tahoe. **Lassen:** Bridge Creek Camp, Summit Camp. **Mariposa:** Lake Tenaya. **Mendocino:** 2.5 air mi N Eel River Ranger Station. **Modoc:** 3 mi E Willow Ranch. **Mono:** Sonora

Pass, Tioga Lake, White Mts. (Blanco's Corral, 10,000 ft, Crooked Creek). **Nevada:** Boca, Sagehen Creek near Hobart Mills. **Shasta:** Lassen Volcanic National Park. **Sierra:** Sardine Creek (ca. 1 mi NW Bassetts). **Siskiyou:** 27 road mi NE Weed **Tuolumne:** Dodge Ridge Ski Area near Strawberry. COLORADO: **Grand:** Troublesome. **Mineral:** Creede. IDAHO: **Bear Lake:** 5 mi W Ovid. **Custer:** Challis. **Fremont:** 6 mi NW St. Anthony, St. Anthony Sand Dunes. **Lincoln:** Kimama, Owinza, Shoshone. **Oneida:** 5 mi NW Holbrook. MONTANA. **Gallatin:** Three Forks. NEVADA: **Elko:** 6 mi S Deeth, Lamoille Canyon. **Humboldt:** Santa Rosa Range. **Pershing:** Lovelock, 7 and 13 mi E Oreana. **Washoe:** Mt. Rose. **County unknown:** Wells. OREGON: **Baker:** Baker, Unity. **Grant:** Dixie Butte Spring. **Harney:** Antelope Mt. in Steens Mts. **Klamath:** Lake of the Woods. **Morrow:** Boardman. **Umatilla:** Hermiston. UTAH: **Cache:** Franklin Basin, Logan Canyon. WASHINGTON: **Yakima:** Toppenish. WYOMING: **Carbon:** Medicine Bow. **Fremont:** Horse Creek Camp (12 mi N Dubois), South Pass. **Sweetwater:** Green River. **Teton:** Jenny Lake, 14 km SW Moran Post Office

Tachysphex hopi sp. n.

(Figures 25, 26)

Derivation of Name.—Named after the Hopi Indians of Arizona; a noun in apposition.

Diagnosis.—Females of *hopi* have an apicomedian process of varying size on the forecoxa (Fig. 25b, c), and slender, elongate tarsomeres IV and V (Fig. 25d, e). This combination of characters distinguishes *hopi* from other species except *bohartorum* and most *occidentalis*. The laterally incised clypeal lip (Fig. 25a) and black femora distinguish *hopi* from *occidentalis* (in which the clypeal lip is entire and the hindfemur is red). The frontal vestiture of *hopi* is silvery (golden in *bohartorum*) and the lateral incision of the clypeal bevel is shallow (deep in *bohartorum*). The apicoventral margin of tarsomere V is concave in *hopi*, slightly less so in *bohartorum*, and straight or nearly so in other species of the *pompiliformis* group.

The male of *hopi* is very similar to *eldoradensis*. See that species for differences (p. 46).

Description.—Punctures subcontiguous on frons, vertex, mesothorax, trochanters, and femora. Mesopleuron dull, microsculptured, its punctures shallow, ill defined. Propodeum microareolate or hindface finely ridged. Sternum II without apical depression. Hindcoxa not carinate.

Integument hidden (or nearly so) by vestiture between antennal socket and orbit. Setae: appressed on mesothorax and femora except subappressed on hypoepimeral area; on vertex erect, about 1.0 MOD long (less than MOD posteriorly); on scutum at middle oriented posterad; on propodeal dorsum mesally nearly appressed, oriented anterolaterad.

Head, thorax, and legs black, tarsal apex reddish. Gaster red in most specimens, but segments IV–VI black in females from Alberta, and segments IV–VII darkened in some males. Terga I–III silvery fasciate apically (fasciae inconspicuous). Wings slightly infumate. Frontal vestiture silvery.

♀.—Clypeus (Fig. 25a): bevel shorter than to longer than basomedian area; lip free margin arcuate to nearly straight mesally, not emarginate mesally, shallowly incised laterally. Dorsal length of flagellomere I 2.1–2.2× apical diameter. Vertex width 1.4–1.5× length. Discal punctures of tergum II up to several diameters apart. Tergum V with impunctate apical depression. Pygidial plate punctate, alutaceous to unsculptured between punctures. Forecoxa with apicomedian process of varying size (Fig. 25b, c). Hindtarsomeres IV and V slenderer than average in the *pompiliformis* group (Fig. 25d, e), hindtarsomere IV emarginate at about 0.75 of its length. Length 8.5–11.0 mm.

♂.—Mandibular inner margin with tooth (Fig. 25f). Clypeus (Fig. 25f): lobe unusually narrow, distance between lip corners equal to about 0.6 of clypeal length and to 0.45–0.7 (usually 0.5–0.6) of distance between lip corner and orbit; free margin of lip arcuate; a short carina emerging from each corner; bevel shorter than basomedian area, indistinctly delimited from the latter. Dorsal length of flagellomere I 1.0–1.2× apical diameter.

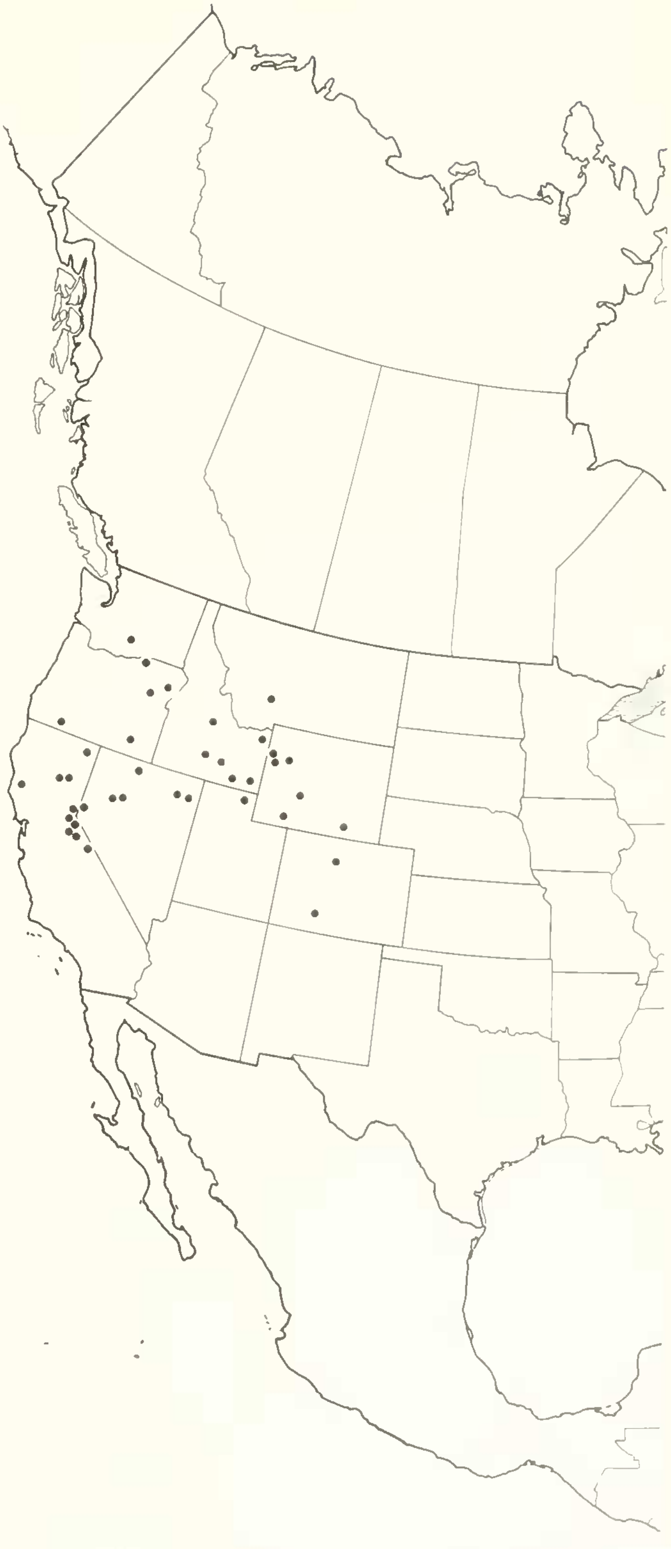

Figure 24 Geographic distribution of *Tachysphex eldoradensis* Rohwer.

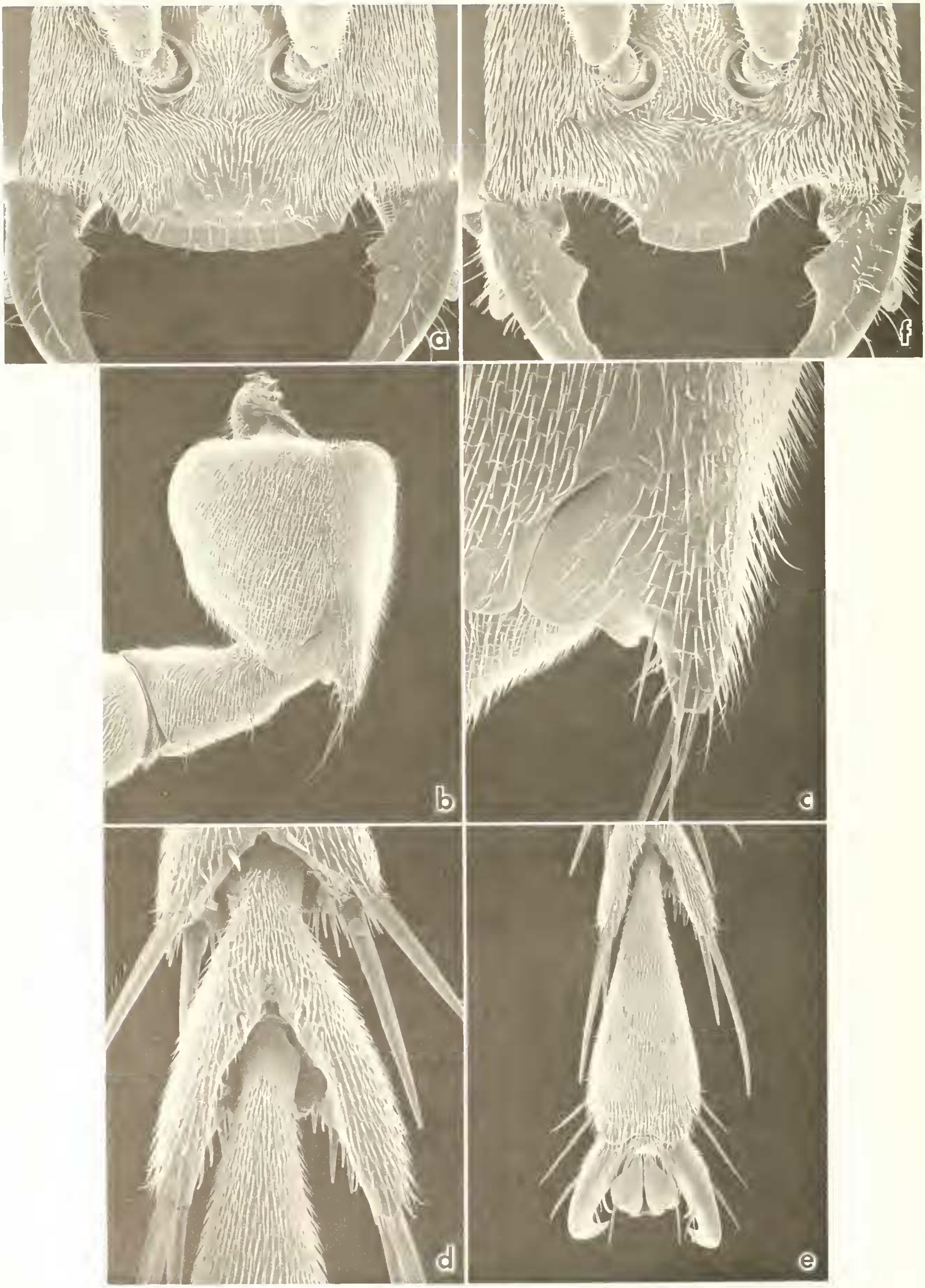

FIGURE 25. *Tachysphex hopi* sp. n.: a—female clypeus, b—female forecoxa; c—apex of female forecoxa, d—female hindtarsomere IV, e—female hindtarsomere V, f—male clypeus.

Vertex width 1.6–1.8× length. Discal punctures of tergum II one to two diameters apart. Sternal punctures about as large as those on the mesothoracic venter; sterna II–IV in most specimens with narrow, impunctate zone apically, but punctate throughout in the single male from Laguna Hanson area, Baja California. Forefemoral notch glabrous. Forebasitarsus with three to five preapical rake spines; outer apical spine of foretarsomere II slightly longer than foretarsomere III. Length 6.5–10.0 mm.

LIFE HISTORY.—Several females from Owinza, Idaho, are pinned with their prey, larvae of *Oedaleonotus aenigma* (Scudder); they are the specimens referred to by Newton (1956). A female from the Bliss area, Idaho, is pinned with an acridid nymph, probably *Aulocara elliotti* (Thomas), det. D. C. F. Rentz. A female from the Saint Anthony area, Idaho, was collected on flowers of *Helianthus annuus* L.

GEOGRAPHIC DISTRIBUTION (Fig. 26).—Western United States north to southern Alberta, south to northern Baja California and Arizona, east to Wyoming and Colorado.

COLLECTING PERIOD.—24 April to 12 June (Mexico), 22 April to 5 August (United States), 25 July to 25 August (Canada).

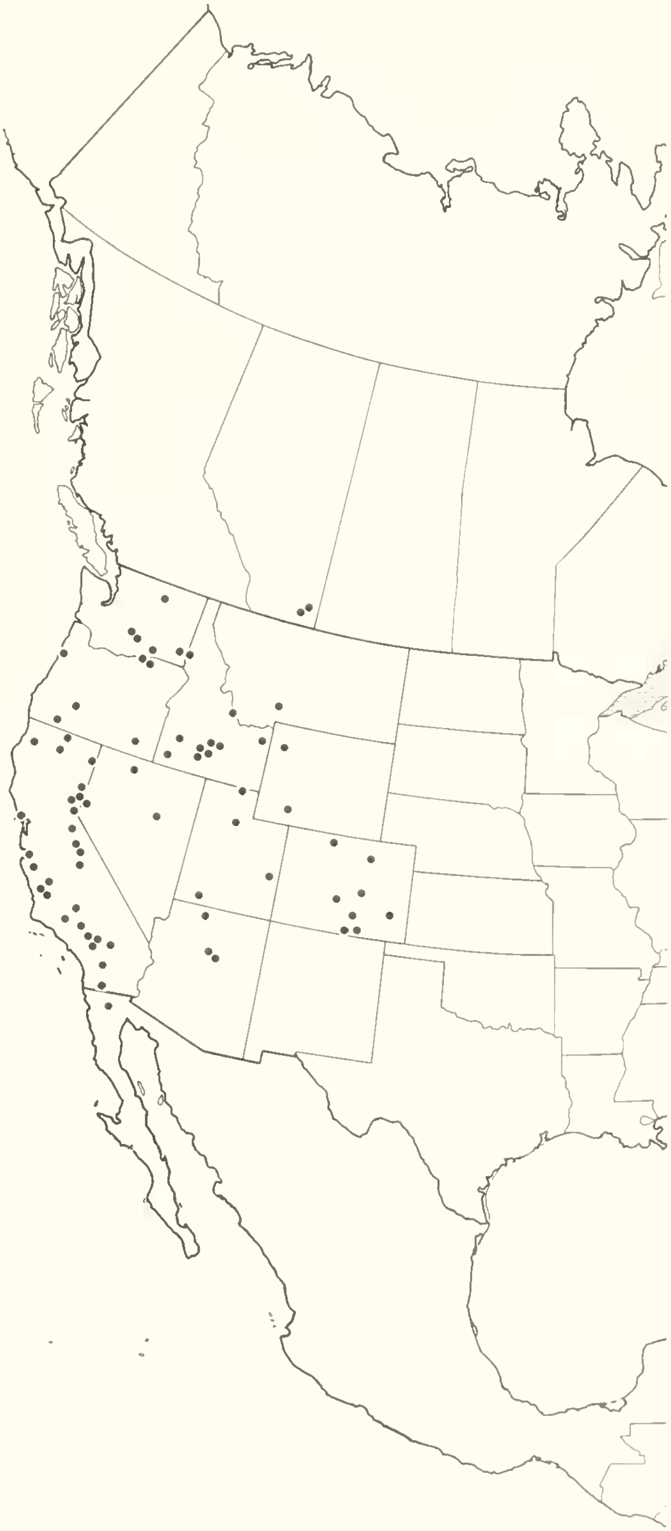

FIGURE 26. Geographic distribution of *Tachysphex hopi* sp. n.

MATERIAL EXAMINED.—Holotype: ♀, Arizona: Apache Co., Canyon de Chelly National Monument, White House ruin, 22 June 1975, ASM and WJP (CAS, Type #15911).

Paratypes (127♀, 125♂, specimens for which depository is not indicated below are all in UCD): CANADA **Alberta:** Medicine Hat, E. H. Strickland (1♀, ANSP); 12 km SW Orion, D. M. McCorquodale (3♀, CAS).

UNITED STATES ARIZONA **Coconino:** Flagstaff, R. C. Miller (1♂, CSDA); 10 mi W Jacob Lake, RMB (1♀); Lake Mary, D. R. Estes (1♀, FSCA); Oak Creek Canyon, Englehardt (1♀, MCZ). CALIFORNIA **El Dorado:** China Flat, F. Bronner (1♀, LACM). **Fresno:** Hume Lake, 5,400 ft, TLG (1♀, TLG); Huntington Lake, NJS (1♀, 1♂, CAS); Los Gatos Canyon, NJS (1♂, CAS). **Humboldt:** North Trinity Mountain, TLG (1♀, TLG). **Inyo:** Big Pine Creek, RMB (1♀). **Kern:** Mt. Pinos, 6,800 ft, JAP (1♀, CIS); Rancheria Creek (Piute Mts.), J. P. and K. E. Donahue (1♀, LACM). **Lassen:** Doyle, EIS (1♂); Hallelujah Junction, RMB (2♀, 2♂, 2♀, CAS), L. D. French (1♀, UCD), J. A. Froebe (3♂), J. S. Glenn (1♂), MEI (1♀, 10♂, UCR; 1♀), D. S. Miller (1♂), R. B. Kimsey and M. L. Siri (1♀, 1♂), C. R. Kovacic (1♀, 2♂), FDP (2♀), JAP (1♀, CIS), JWM (1♀), J. Slansky (1♀, 2♂; 3♂, CAS). **Los Angeles:** 5 mi S Lancaster, EGL and JWMS (1♀, CIS). **Marin:** Point Reyes (Lighthouse), A. M. Barnes (3♀, CIS); Point Reyes, JAP (2♂, CIS). **Mariposa:** Yosemite, EGL (1♀). **Modoc:** 5.5 mi E Cedarville, D. R. Miller (3♂; 1♂, CAS), V. L. Vesterby (3♂). **Monterey:** Marina, coastal sand dunes, MEI (2♂, UCR); Soledad, RMB (1♂), 1 mi S Soledad, R. W. Thorp (1♀, CIS). **Placer:** Carnelian Bay on Lake Tahoe, FDP (1♀). **Plumas:** Chilcoot, J. S. Buckett (1♂), N. B. and W. M. Elliott (1♀, 2♂, NYSU; 1♂, CAS). **Riverside:** Hemet Lake, EIS (1♀). **San Bernardino:** 2 mi E Baldwin Lake, Beesley (1♂, UCR); 2 mi NE Baldwin Lake, S. Freeman (1♀, UCR); Bear Valley, E. C. Van Duzee (1♀); 2 mi W Phelan, J. C. Hall (1♀, 1♂), EIS (1♂); Rock Corral, DKF (1♀, SDNH); Seeley Flat (San Bernardino Mts.), R. May (1♀, LACM). **San Diego:** near Buckman Springs, FXW (1♀, CAS), Warner Springs, RCB (1♀). **San Luis Obispo:** Paso Robles, E. P. Van Duzee (1♂); 10 mi W Simmler, PDH (2♂, CIS). **Sierra:** Yuba Pass, RMB (1♀). **Siskiyou:** Dorris, WJP (1♂, CAS); McBride Springs (3 mi NNE Mt. Shasta town), L. Green (1♂, UCD); Mt. Shasta town, WJP (1♂, CAS). **Tuolumne:** Strawberry, P. D. Ashlock (1♀, USNM), EGL (1♀), JWMS (1♂). **Ventura:** Lockwood Valley, EIS (1♀). COLORADO. **Bent:** 4 mi S Hasty, ASM and WJP (2♀, WJP). **Chaffee:** Salida, R. Roberts (1♀). **Costilla:** Ute Creek (Sage Flats), L. Bruner, named as *neomexicanus* by C. E. Mickel (1♀, UNL). **El Paso:** Colorado Springs, R. and R. Dreisbach (1♀, 9♂; 2♂, CAS). **Huerfano:** Gardner, B. Rotger C. R. (1♀, USNM). **Jackson:** 3 mi E Cowdrey, HEE (1♀, CAS). **Las Animas:** Starkville, collector unknown (1♀). **Weld:** Roggen, HEE (1♀, CAS), collector unknown (1♀, CAS); 1 mi NE Roggen, WJP (5♀, 3♂, CAS). Also the following specimens labeled "Col." (probably Colorado), 1♀, 3♂ (CU), 1♀, 1♂ (USNM). IDAHO: **Blaine:** 3 mi NW Carey, DSH (1♂, UIM). **Camas:** 23 mi E Fairfield, WFB (1♂, 3♂, UIM), DSH (1♀, UIM). **Elmore:** 6 mi S Sunnyside, L. S. Hawkins (1♂, UIM). **Fremont:** Saint Anthony Sand Dunes, MSW (8♀, 3♂, CSDA), R. L. Westcott (1♀, UIM), 6 mi NW Saint Anthony, WFB (1♀, UIM), DSH (1♀), R. L. Westcott (1♂, UIM). **Gooding:** 5 mi N Bliss, JEG (1♀). **Latah:** S slope of Moscow Mt., DSH (1♀, UIM). **Lemhi:** Lemhi Pass, WFB (1♂, UIM). **Lincoln:** Owinza, Lee Seaton (7♀, USNM); Shoshone, R. L. Newton (3♀, 6♂, USNM); 18 mi E Shoshone, R. C. Newman (1♀, 2♂, USNM). **Madison:** Lincoln, R. C. Newton (2♂, USNM). **Owyhee:** Little Valley (18 mi SW Bruneau), A. R. Gittins (1♂, UIM). MONTANA: **Gallatin:** Three Forks, E. C. Van Duzee (8♀; 1♀, CAS). NEVADA **Eureka:** Diamond Valley, P. C. Martinelli (1♀, NSDA). **Humboldt:** Orovada, FDP (1♂). **Washoe:** 1 mi S Mustang, FDP (1♀, NSDA), Red Rock, RCB (2♀, USU), Reno, FDP (2♀, NSDA); 15 mi E Reno, RMB (1♀), MEI (1♀); Verdi, RMB (2♂, 1♂ CAS), E. J. Montgomery (1♂). OREGON **Harney:** Virginia Valley, 30 mi SW Follyfarm (S end of Alvord Desert), H. A. Scullen (1♂). **Jackson:** Ashland Mt. (above timberline), H. A. Scullen

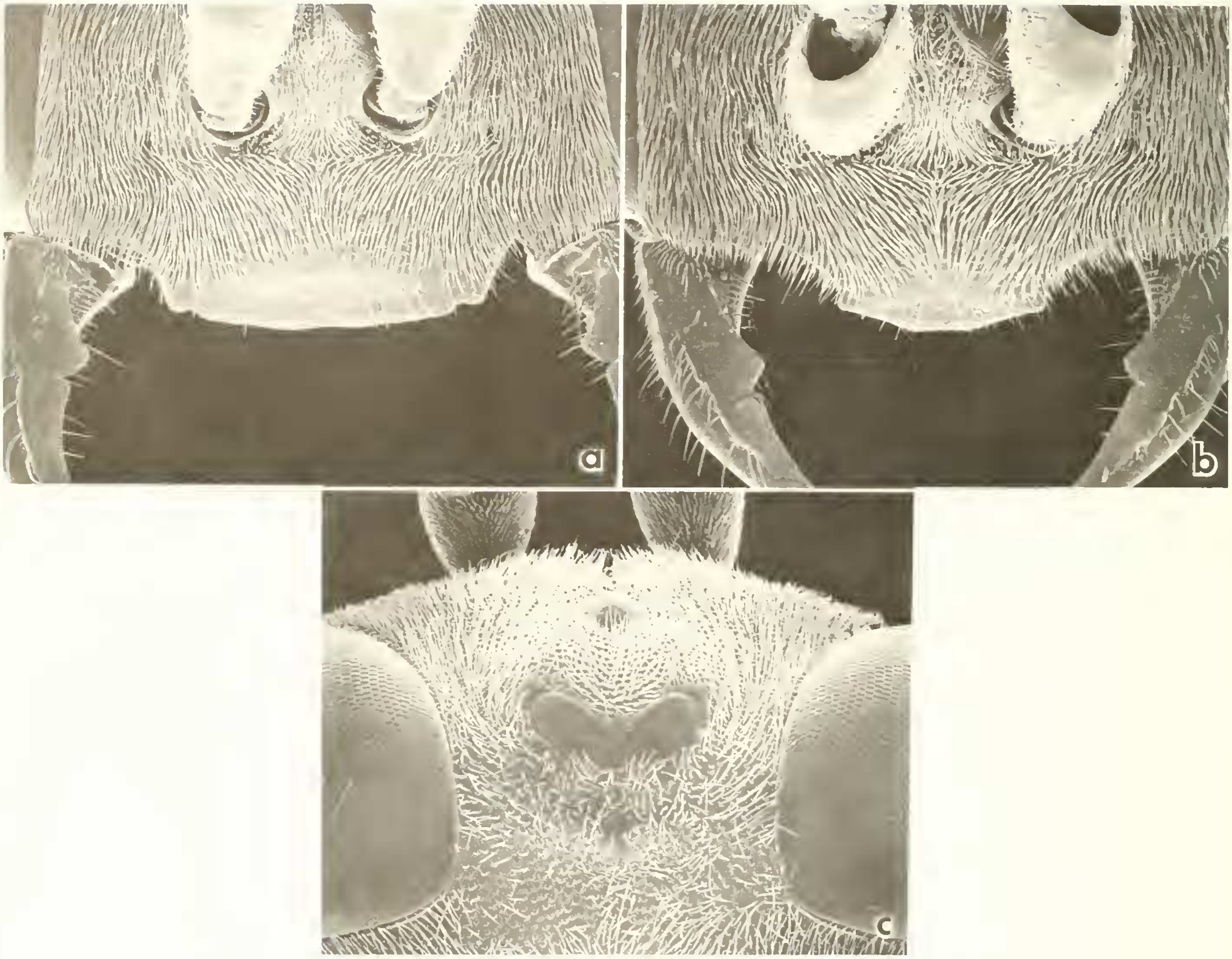

FIGURE 27. *Tachysphex pechumani* Krombein: a—female clypeus, b—male clypeus, c—male vertex.

(1♀). **Klamath:** Crater Lake National Park, I. Schuh (1♂). **Lincoln:** Owynza, JEG (1♂). **Morrow:** Boardman, G. R. Ferguson (2♀, 4♂, 1♀, CAS). **Umatilla:** "Camp Umatilla W. T. June 26, '82," collector unknown (1♀, MCZ), Hermiston, collector unknown (1♀). UTAH. **Cache:** Cornish, GEB (13♂, 2♀, CAS; 3♀, USU), RMB (1♀), EDP and D. Vincent (1♀, USU). **Grand:** 25 mi S Moab, GEB and R. Brumley (1♀, WJP; 1♂). **Washington:** Zion National Park, collector illegible (1♀, USU). Also Salt Lake (county not indicated), collector unknown (1♀). WASHINGTON. **Benton:** 2 mi S Pasco, E. D. Dailey (1♂, WSU). **Garfield:** Snake River 4 mi below Lower Granite Dam, J. Jenkins (1♀, CAS). **Okanogan:** Okanogan, DSH (1♂, UIM). **Yakima:** N Yakima, E. Jenne (2♀, WSU). WYOMING. **Sweetwater:** Green River, collector unknown (1♀, AMNH). **Teton:** Gridger Basin, S. Garman (1♀, MCZ).

MEXICO. **Baja California Norte:** 12.3 mi S El Condor, DKF (1♀, SDNH). Sierra Juarez 6 mi N Laguna Hanson, collector unknown (♂, SDNH).

Tachysphex pechumani Krombein

(Figures 27, 28)

Tachysphex tarsatus subsp. *pechumani* Krombein, 1938:468, ♀, ♂. Holotype: ♀, New Jersey: Ocean Co.: Manahawkin (USNM). — As *Tachysphex pechumani*: G. Bohart 1951:952 (new status), Krombein 1967:393, Kurczewski et al. 1970: 1594 (?), Bohart and Menke 1976:275, Kurczewski and Elliott 1978:765–780, Krombein 1979:1629.

DIAGNOSIS. — *Tachysphex pechumani* occurs in Michigan and New Jersey. The female has a brassy golden frontal vestiture, a character that distinguishes it from other species of the *pompiliformis* group except *bohartorum*, *psilocerus*, and *scopaeus* (some other species may have a golden tinge). The unspecialized upper metapleuron of *pechumani* separates it from *psilocerus* and *scopaeus*, and the following characters differentiate it from *bohartorum*: the shallowly incised clypeal lip (Fig. 27a), the flagellum largely red or at least reddish brown, the posterior (horizontal) part of the mesothoracic venter longer than the anterior (oblique) part, the forecoxa not expanded into a process apically, tarsomeres IV and V are not elongate, and gastral apex black. The broad vertex (width twice length) is an additional diagnostic feature.

In males of *pechumani* the unusually broad vertex (width: length ratio 2.1–2.3) is distinctive (Fig. 27c), but the vertex width is also more than twice length in other species (at least in occasional specimens). These differ from *pechumani* in having the characters listed in parentheses: *antennatus* (vertex setae appressed), *crassiformis* (expanded axilla), *glabrior* (punctate mesopleuron), *idiotrichus* (unusually long vestiture, compressed forefemoral notch), *psammobius* (punctate mesopleuron, triangular clypeal lip), *punctifrons* (peculiar mesopleural carinae), and *scopaeus* (punctate mesopleuron, peculiar metapleuron).

DESCRIPTION. — Frons, vertex, and scutum punctate, punctures nearly contiguous. Mesopleuron opaque, microsculptured, shallowly, indistinctly punctate. Propodeal dorsum evenly microareolate, side microsculptured, not ridged; hindface at most with a few, inconspicuous ridges. Discal micropunctures of tergum II about one diameter apart. Sternum I apically at most with shallow, indistinct depression. Hindcoxa not carinate.

Vestiture partly obscuring integument between antennal socket and orbit. Vertex setae erect (suberect posteriorly in female), 1.0 MOD long. Terga I–IV or I–V silvery fasciate apically. Scutal and femoral setae appressed.

♀.—Clypeus (Fig. 27a): bevel shorter than basomedian area; lip broadly arcuate, shallowly incised laterally. Dorsal length of flagellomere I 2.0–2.4 × apical width. Vertex width twice length. Tergum V densely punctate, its apical depression impunctate in some individuals. Pygidial plate alutaceous, punctate. Trochanteral and femoral punctures fine, subcontiguous. Length 9–11 mm.

Head and thorax black; flagellomeres II–X or III–X reddish brown to orange red (yellow in live specimens according to F. E. Kurczewski, pers. comm.), III–V infumate beneath in some specimens. Gastral segment I and II or I–III red, remainder black. Legs black, tarsal apex reddish. Clypeal and frontal vestiture brassy golden. Wings moderately infumate.

♂.—Mandibular inner margin with tooth (Fig. 27b). Clypeus (Fig. 27b): bevel shorter than basomedian area; lip arcuate or slightly sinuate; its corners rectangular to obtuse, separated by a distance that equals 0.9–1.1 of distance between corner and orbit. Dorsal length of flagellomere I 1.1–1.4 × apical width. Vertex width 2.1–2.3 × length (Fig. 27c). Sterna densely punctate throughout. Forefemoral notch glabrous. Forebasitarsus with two or three preapical rake spines. Outer apical spine of foretarsomere II as long as tarsomere III. Length 6–10 mm.

Body black, including legs, but terga I–III in some specimens with small, reddish zones. Frontal vestiture silvery. Wings faintly infumate.

Life History.—*Tachysphex pechumani* has been studied in detail by Kurczewski and Elliott (1978). There is one generation per year. Females nest in sandy or gravelly soil (Krombein 1967). Females searching for a nesting site: (1) walk relatively slowly, (2) pause abruptly and make zigzag turns (so that movements appear jerky), (3) keep antennae bowed, tapping the tips alternately on the soil, occasionally raising and waving them, and (4) keep wings flat over the gaster, raising them to an angle of about 45° with the dorsum before taking flight. When starting a nest, the female first breaks the sand crust with her mandibles, then she digs a burrow with her forelegs which work in unison. She periodically removes the sand that has accumulated by raking it backwards with her forelegs. The sand finally forms a flattened, fan-shaped tumulus. The burrow, 6 mm in diameter and 45–85 mm long, enters the soil at an angle of 10–30° to the surface. It ends in a single cell, which is 20–40 mm beneath the surface. After completion, the nest is temporarily closed, although the closure may be incomplete (the entrance frequently remains open at the top). After closing the nest, the female periodically walks back to the nest, examines the entrance, turns, and walks away. Probably these are efforts to memorize the nest location. The observed prey are nymphal and adult acridids: *Orphulella pelidna* (Burmeister), *Melanoplus impudicus* Scudder, *fasciatus* (Walker), and *sanguinipes* (F.). The acridids are paralyzed by one to three stings (this observation may be inaccurate). Paralysis is incomplete: the prey dug out of the wasp's nest move their mouthparts, antennae, and occasionally other appendages, and breathing movements of their abdominal segments are visible. Heavy prey (more than twice the female weight) are transported on the ground but lighter prey are flown to the nest. During ground transport, the female walks on her fore- and midlegs, and proceeds forward. The prey is straddled venter up; its antennae are held with her mandibles, and its body is clutched by her hindlegs. It is dropped at the nest entrance, venter up and head toward the nest. The female then opens the nest, enters, reappears headfirst, grasps the prey's antennae with her mandibles, and drags it inside. Only one prey per cell was found in fully provisioned cells. Prey position in the cell is venter up and head inward. The wasp's egg is attached by its caudal end "to the forecoxal corium of the prey."

Geographic Distribution (Fig. 28).—*Tachysphex pechumani* is known from two isolated areas: the Pine Barrens in southern New Jersey and the Lower Peninsula of Michigan. Both areas (except Saginaw Co., Michigan) are mainly dry, sandy soils covered with pine forest. G. Bohart (1951) lists New York State for this species, but neither I nor F. E. Kurczewski (pers. comm.) have seen material from that area, and Kurczewski and Elliott (1978) were unable to find *pechumani* in pine-barren areas of upstate New York and Long Island.

Material Examined.—47♀, 84♂ (AMNH, CAS, CSU, CU, KVK, MCZ, MOB, UCD, UMMZ, USNM).

Records.—UNITED STATES: MICHIGAN: **Allegan:** Allegan State Game Area. **Cheboygan:** Douglas Lake. **Crawford, Gladwin, Gratiot, Iosco, Kalkaska, Midland, Montcalm, Saginaw:** —. **Oakland:** Farmington. **Washtenaw:** Pinckney State Recreation Area near Half Moon Lake. NEW JERSEY: **Atlantic:** Weymouth, Elwood (Kurczewski et al. 1970; Kurczewski and Elliott 1978). **Burlington:** Browns Mills, Chatsworth, Lebanon State Forest, New Gretna, Ong, Rancocas Park, Vincentown (Kurczewski et al. 1970). **Camden:** Atco, Clementon. **Cape May:** 3 mi S Seaville. **Cumberland:** Manumuskin, Vineland (Maurice River). **Gloucester:** Iona (Kurczewski et al. 1970). **Ocean:** Lakehurst (Wrangle Brook Road), Manahawkin.

Tachysphex bohartorum Pulawski

(Figures 28–30)

Tachysphex bohartorum Pulawski, 1982:30, ♀, ♂. ! Holotype ♀, California: Nevada Co.: Boca (UCD).

Diagnosis.—The female of *bohartorum* differs from most New World species in having a distinctive mesothoracic venter: the posterior, horizontal part is shorter than the anterior, oblique part (the mesothorax of *hopi* and *occidentalis* approaches this condition). Like the female of *hopi* and many *occidentalis*, the forecoxa is expanded into an apicomedian process (Fig. 29b, c), and tarsomeres IV and V (Fig. 29d, e) are unusually long (unlike *occidentalis*, the hindfemur of *bohartorum* is all black, and the clypeal lip is incised laterally). Like *pechumani*, it has brassy golden frontal vestiture, but unlike that species the gaster of *bohartorum* is all red and the flagellum is all black. The frontal vestiture is also golden in *psilocerus* and *scopaeus*, but these species have a distinctive upper metapleuron (flange broad, an oblique lamella extending from its fore end). The male of *bohartorum* can be recognized by the closely punctate terga (punctures almost contiguous) combined with the apicomesally impunctate and glabrous sterna II–IV (Fig. 30a–c).

Supplementary diagnostic characters of *bohartorum* are: propodeum not ridged (at most the hindface has a few, inconspicuous ridges below); setae of propodeal dorsum appressed mesally, oriented obliquely anterad; female tergum V entirely punctate.

Description.—Punctures subcontiguous on frons, vertex,

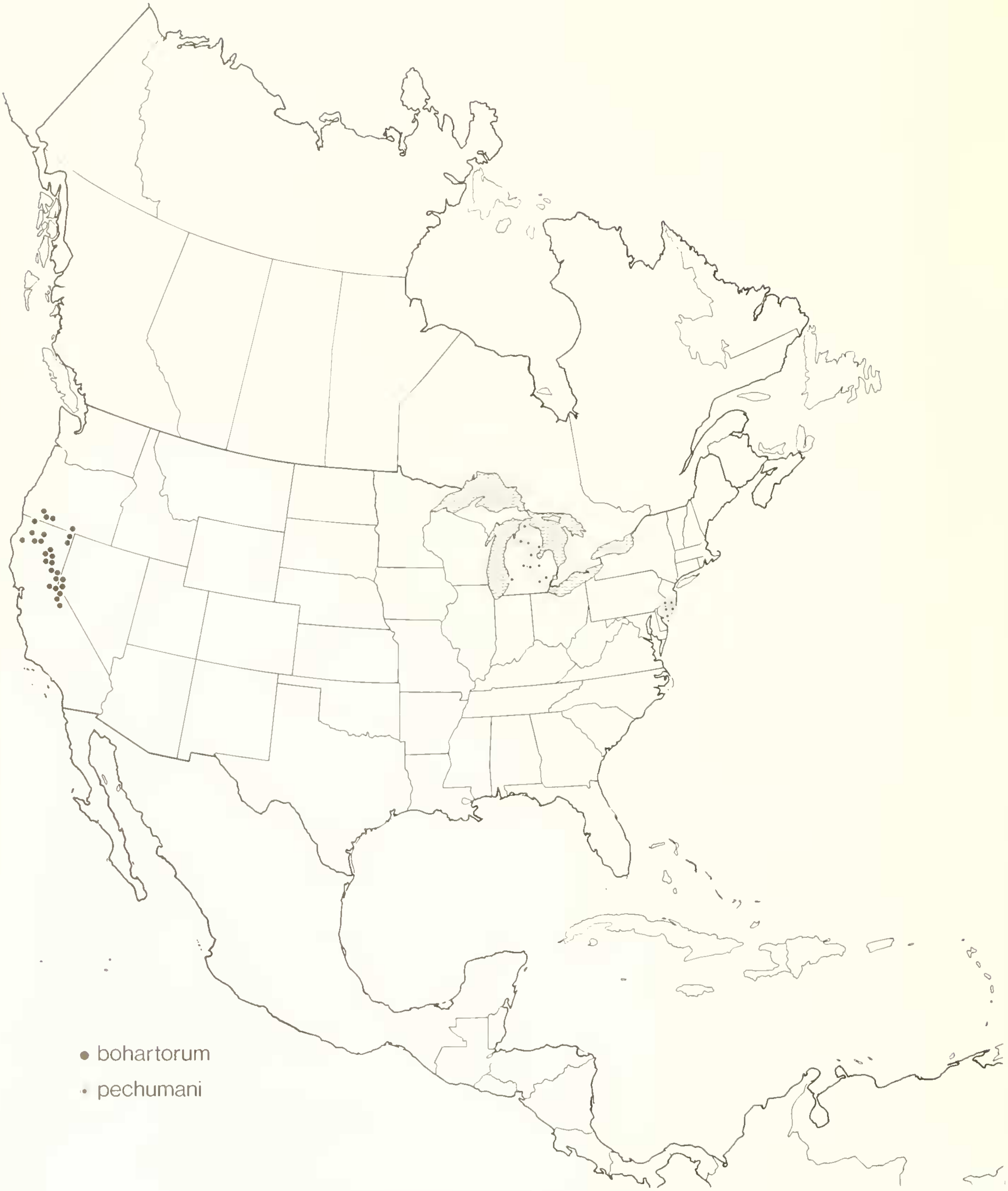

FIGURE 28. Geographic distribution of *Tachysphex pechumani* Krombein and *bohartorum* Pulawski.

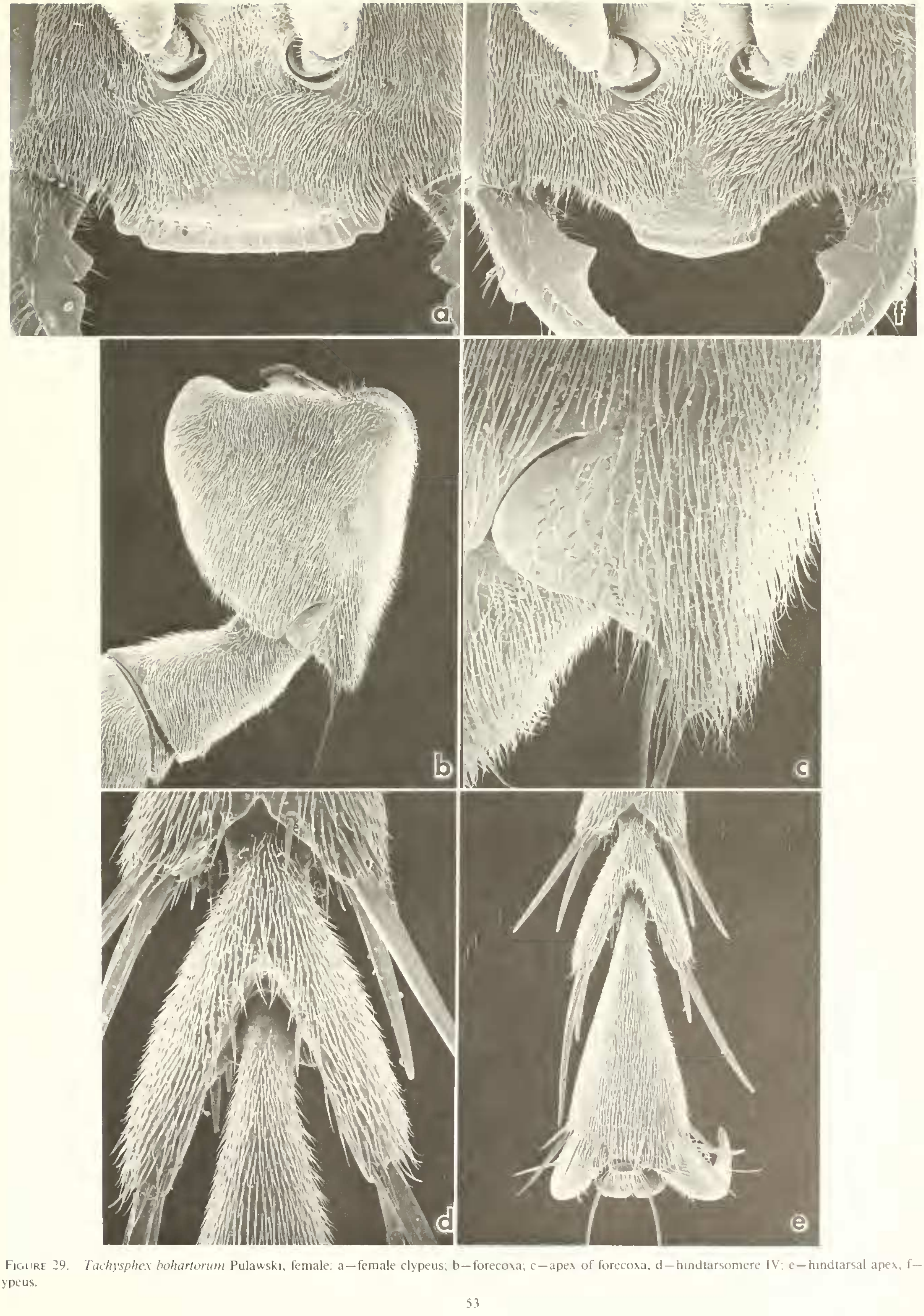

FIGURE 29. *Tachysphex bohartorum* Pulawski, female: a—female clypeus; b—forecoxa; c—apex of forecoxa, d—hindtarsomere IV; e—hindtarsal apex, f—male clypeus.

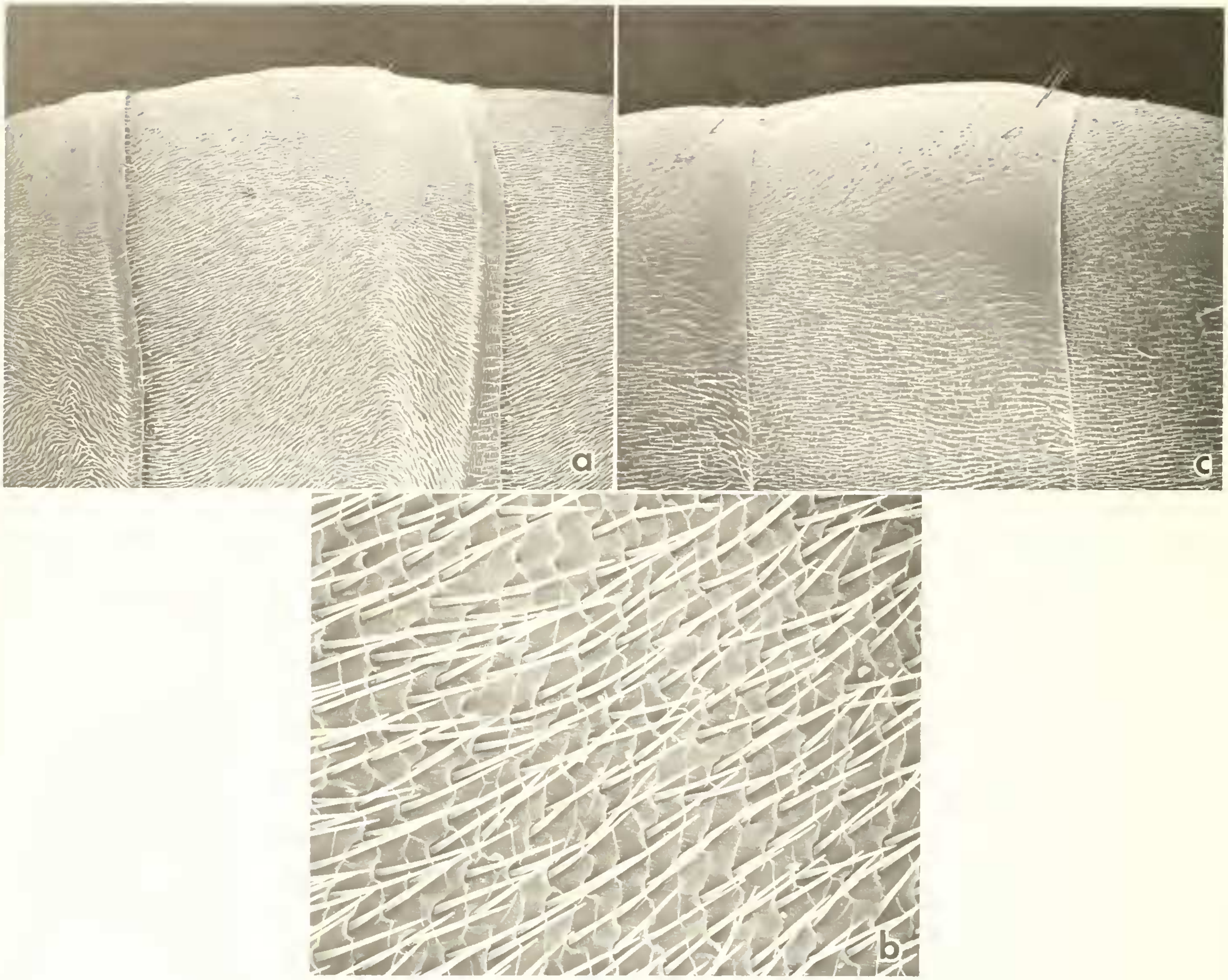

FIGURE 30. *Tachysphex bohartorum* Pulawski, male: a—tergum II; b—sculpture of tergum II; c—sternum III.

mesothorax, trochanters, and femora. Mesopleuron dull, microsculptured, its punctures shallow, ill defined. Propodeum microareolate, at most hindface with a few, inconspicuous ridges beneath; dorsum usually with median carina of varying length. Sternum I apically at most with shallow, indistinct depression. Terga I–V (female) or I–VII (male) evenly, closely punctate throughout, punctures mostly subcontiguous. Hindcoxa not carinate.

Integument obscured by vestiture (not totally so in smallest specimens) between antennal socket and orbit. Setae: appressed on mesothorax and femora except subappressed on hypoepimeral area; on vertex subappressed to (some male) erect, shorter than MOD, on scutum at middle oriented posterad or posterolaterad; on propodeal dorsum mesally appressed, oriented anterolaterad.

Head, thorax, and legs black, tarsi (except basally) reddish. Gaster red or (some males) segments IV–VII dark brown. Terga I–IV silvery fasciate apically (tergum IV only weakly so). Wings infumate.

♀.—Clypeus (Fig. 29a): bevel about as long as basomedian area; lip free, margin straight or slightly concave, deeply incised laterally. Dorsal length of flagellomere I 2.3–2.6 × apical width. Vertex width about 1.8 × length. Mesothoracic venter peculiar: its posterior, horizontal part shorter than anterior, oblique part. Pygidial plate alutaceous, punctate. Forecoxa with apicomedian process (Fig. 29b, c). Tarsomeres IV and V unusually long (Fig. 29d, e). Length 9–11 mm.

Clypeal and frontal vestiture brassy golden.

♂.—Mandibular inner margin with tooth (Fig. 29f). Clypeus (Fig. 29f): bevel equal to basomedian area or shorter; lip arcuate or (some specimens) sinuate, its corners rectangular to obtuse; distance between corners equal to 0.7–0.8 of clypeal length and of distance between corner and orbit; longitudinal carina emerging from each corner and extending dorsad slightly beyond lip base. Dorsal length of flagellomere I 1.3–1.5 × apical width. Vertex width 1.7–1.9 × length. Tergal punctures unusually dense (Fig. 30a, b); sternal punctures about as large as those on mesothoracic venter; sternum III impunctate posteromesally, sterna

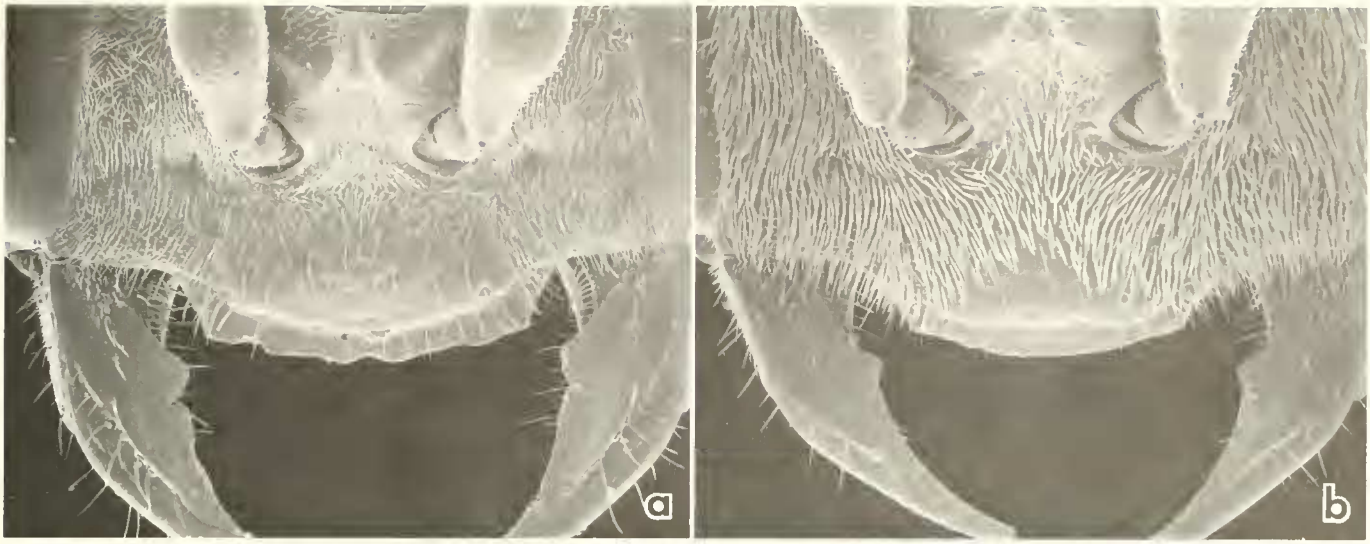

FIGURE 31. *Tachysphex irregularis* Pulawski: a—female clypeus; b—male clypeus.

II–IV impunctate on apical depression (Fig. 30c), at least mesally. Forefemoral notch glabrous. Forebasitarsus with two or three preapical rake spines; outer apical spine of foretarsomere II longer than foretarsomere III. Length 5–8 mm.

Frontal vestiture silvery or with golden tinge.

GEOGRAPHIC DISTRIBUTION (Fig. 28).—North and central Sierra Nevada (both in California and Nevada) and adjacent mountain ranges in northern California and southern Oregon.

MATERIAL EXAMINED.—98♀, 285♂.

RECORDS.—UNITED STATES CALIFORNIA: **Alpine:** Carson Pass, Hope Valley, 15 mi NE Red Lake, Winnemucca Lake, Woodfords. **Del Norte:** Little Grayback (NE part of county). **El Dorado:** Echo Pass, Echo Lake, Echo Portal, Fallen Leaf Lake, Kyburz Flat, Meyers, Tahoe, Strawberry Valley. **Humboldt:** Red Cape Lake. **Inyo:** Big Pine Creek, near Mono Pass (12,000 ft). **Lassen:** Bridge Creek Camp, Summit Camp (E Lassen Peak). **Mariposa:** Sentinel Dome Cutoff (Yosemite National Park). **Modoc:** 2 mi W Cave Lake, Cedar Pass (Warner Mts.), Warner Mts. 2 mi NNW Fort Bidwell. **Mono:** 11 mi N Bridgeport, East Walker River (13 mi NE Bridgeport), Leavitt Meadow, Parker Creek (8 mi S Lee Vining), S Fork Cottonwood Creek (Sweetwater Mts.). **Nevada:** Boca, Sagehen Creek near Hobart Mills. **Placer:** Carnelian Bay (Lake Tahoe), Devil's Peak, Tahoe (also 2 mi NE). **Plumas:** Bucks Lake, Lake Almanor, Meadow Valley, 14 mi W Quincy. **Shasta:** Lake Eiler (ca. 20 mi S Burney), Lassen Peak, Tamarack Lake. **Sierra:** Independence Lake, Sierra Buttes, Sierra Valley, Sierraville, Yuba Pass. **Siskiyou:** 1 mi E Ash Creek Ranger Station (9 mi E McCloud), Martin's Dairy (8 mi NW Macdoel), McBridge Springs (3 mi NNE Mt. Shasta town), Mt. Shasta town, 1 mi SE Salmon Mt. **Trinity:** Coffee Creek Ranger Station. **Tuolumne:** Chipmunk Flat (3 air mi W Sonora Pass), Dardanelle, Sonora Pass. NEVADA **Douglas:** Spooners Lake N Junction Hwy. 28. **Washoe:** Mt. Rose. OREGON: **Jackson:** 8 mi SE Butte Falls, Mt. Ashland. **Klamath:** 15 mi NE Bly, Eagle Ridge near Klamath Lake, Lake of the Woods. **Lake:** Warner Pass.

Tachysphex irregularis Pulawski

(Figures 31, 32)

Tachysphex irregularis Pulawski, 1982:31, ♀, ♂. ! Holotype: ♀, California: Lassen Co.: Hallelujah Junction (UCD).

DIAGNOSIS.—*Tachysphex irregularis* differs from other members of the *pompiliformis* group in having a rugose or punctatorugose mesopleuron. Additional recognition features are: trochanteral venter almost impunctate in most females, and in the male: graduli present on sterna III–VI, sternal punctures about as large as those on the mesothoracic venter.

DESCRIPTION.—Punctures shallow, subcontiguous on frons and vertex; less than one diameter apart on scutum (but many discal punctures more than one diameter apart in some specimens). Mesopleuron punctatorugose or rugose. Propodeal dorsum evenly microareolate, side ridged in most specimens, hindface ridged. Sternum I without apical depression. Hindcoxa carinate basally.

Setae appressed on scutum and midfemoral venter, on scutum at middle oriented almost uniformly posterad.

Head and thorax black. Terga I–V silvery fasciate apically (fascia of female tergum V broadly interrupted). Wings weakly infumate.

♀.—Clypeus (Fig. 31a): bevel longer than basomedian area; lip varying, mainly with median emargination and with one lateral indentation on each side, but simply arcuate in some specimens. Dorsal length of flagellomere I 2.4–2.7 × apical width. Punctures of mesothoracic venter about one diameter to (some specimens) many diameters apart. Most micropunctures of tergum II at middle about one diameter apart. Tergum V densely punctate (except mesally), but apical depression impunctate. Pygidial plate shiny, sparsely punctate. Trochanteral venter shiny, with scattered punctures (but punctures close to each other in a female from Las Cruces, New Mexico, UCD). Forefemoral punctures fine, dense (two to three diameters apart in most specimens). Length 8–11 mm.

Integument not hidden under vestiture between antennal socket and orbit. Vertex setae about 0.5 MOD long, subappressed posteriorly, suberect anteriorly.

Gaster red. Legs usually black, with reddish tarsal apex, but in occasional specimens the following are red: hindfemur, hindtibia, and partly fore- and midtibia. Frontal vestiture silvery or with golden tinge.

♂.—Mandibular inner margin with tooth (Fig. 31b). Clypeus (Fig. 31b): bevel shorter to longer mesally than basomedian area; lip arcuate, its corners usually closer to orbits than to each other, but slightly closer to each other than to orbits in some individuals. Dorsal length of flagellomere I 1.7–2.0 × apical width. Vertex width 1.5–1.9 × length. Sternal punctures conspicuous,

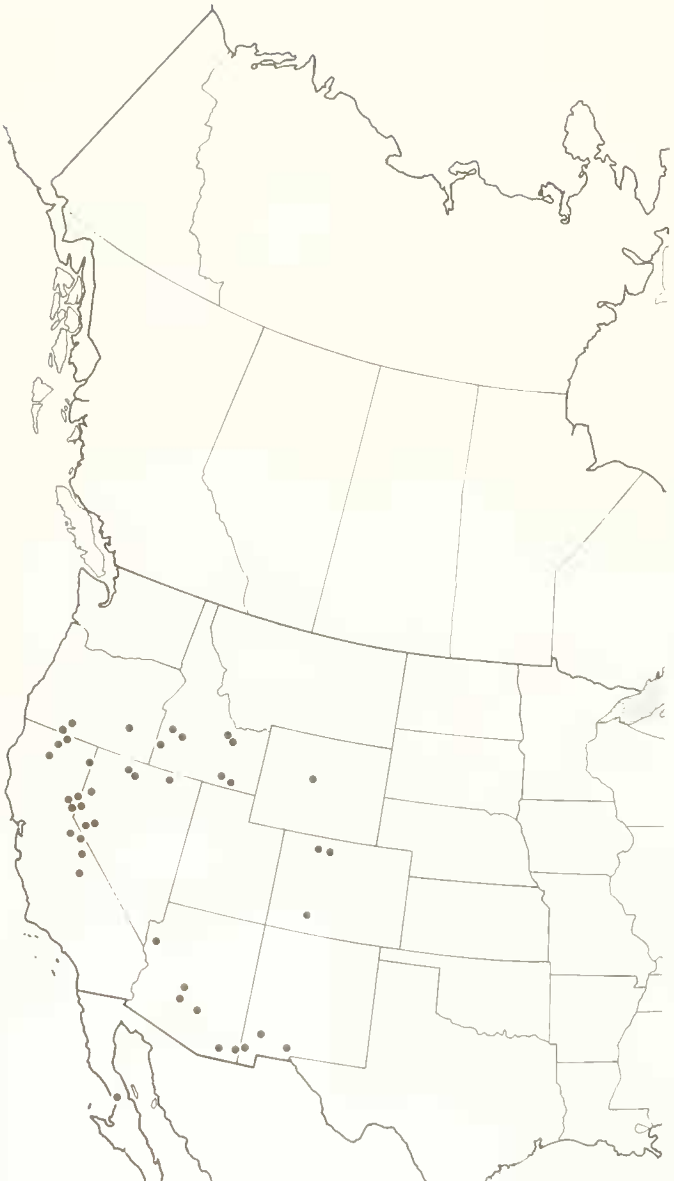

FIGURE 32. Geographic distribution of *Tachysphex irregularis* Pulawski

about as large as those on mesothoracic venter, subcontiguous or up to two or three diameters apart mesally; sterna III–VI with graduli. Forefemoral notch finely pubescent. Forebasitarsus with none to four preapical rake spines that are at most scarcely longer than basitarsal width; outer apical spine of forebasitarsus II much longer than forebasitarsus III. Length 7.5–10.5 mm.

Integument totally hidden under vestiture between antennal socket and orbit when seen from certain angles. Vertex setae erect, 0.5–0.7 MOD long.

Gastral segments I–III red, remainder black (only segments I and II or II and III red in some individuals). Legs black, tarsal apex brown. Frontal vestiture silvery.

GEOGRAPHIC DISTRIBUTION. (Fig. 32).—Western United States, eastward to Wyoming and New Mexico, also Baja California Norte.

MATERIAL EXAMINED.—65♂, 45♀ (AMNH, CAS, CIS, CSDA, CSU, FSCA, MCZ, TLG, UAT, UCD, UIM, USNM, USU).

RECORDS.—UNITED STATES. ARIZONA: **Cochise:** 8 mi NE Apache, 14 mi W Tombstone. **Maricopa:** Rainbow Valley, route 74 (5 mi W route 17). **Mohave:** 4 mi W Chloride, Kingman. **Pinal:** 8 mi SE Olberg. CALIFORNIA. **Inyo:** Bishop, Whitney Portal. **Lassen:** Hallelujah Junction. **Modoc:** 5.5 mi E Cedarville, Hot Creek. **Mono:** Benton Crossing. **Nevada:** Boca, Sagehen Creek near Hobart Mills. **Sierra:** Sattley. **Siskiyou:** Dorris, Macdoel, Hatfield, Mt. Shasta town, Red Rock. **Tuolumne:** Sonora Pass. COLORADO. **Jackson:** 10 mi N junction of roads 14 and 40. **Mineral:** South Clear Creek. **Routt:** 7 mi E Hayden. IDAHO: **Butte:** 6 mi S Howe (also 7 mi E). **Canyon:** Nampa. **Cassia:** 4 mi SE Malta (also 5 mi N). **Custer:** 2 mi E Leslie. **Elmore:** 4 mi E Orchard. **Oneida:** 5 mi NW Holbrook. **Owyhee:** Silver City (also 17 mi W). NEVADA. **Elko:** Cobb Creek (6 mi SW Mountain City). **Humboldt:** Orovada, Paradise City (also 15 mi E). **Lyon:** Smith. **Mineral:** 4.5 mi S Schurz. **Washoe:** Pyramid Lake, Reno Hot Springs, Sky Ranch near Reno. NEW MEXICO. **Dona Ana:** Las Cruces. **Grant:** Hurley. **Hidalgo:** Rodeo. OREGON. **Harney:** "P" Ranch. **Klamath:** 3 mi S Chiloquin, Lower Klamath Lake. WYOMING. **Fremont:** Shoshoni.

MEXICO. **Baja California Norte:** 4 mi NE El Rosarito (28°42′N, 113°58′W), 6 mi NE Santa Rosalillita (28°45′N, 114°10′W).

Tachysphex laevifrons (F. Smith)

(Figures 33–36)

Larrada laevifrons F. Smith, 1856:291, ♀. ! Holotype: ♀, Florida: Duval Co., St. John's Bluff, now Jacksonville (BMNH, London).—In *Larra*: Cresson 1862:237. Patton 1881:389. Kohl 1885:245. Provancher 1887:267 (♂). W. Fox 1894*a*:492. Dalla Torre 1897:669 (as *levifrons*).—As ?*Tachysphex*: Ashmead 1899:250. Harrington 1902:221.—In *Tachysphex*: G. Bohart 1951:951; Krombein 1958*c*:188. Kurczewski 1966*b*:439, 445. Krombein 1967:393. Kurczewski 1971:114. Bohart and Menke 1976:274. Krombein 1979:1628.

Tachysphex leensis Rohwer, 1911:578, ♀. ! Holotype: ♀, Texas: Lee Co.: no specific locality (USNM). Synonymized by Pulawski *in* Krombein 1979:1628.—G. Bohart 1951:951. Bohart and Menke 1976:274.

Tachysphex consimiloides Williams, 1914:164, ♀. ! Holotype: ♀, Kansas: Barton Co.: no specific locality (KU). Synonymized by G. Bohart 1951:951 (with *Tachysphex leensis*).—LaBerge 1956:527. Arnaud 1970:32.

DIAGNOSIS.—*Tachysphex laevifrons* can be recognized by the combination of appressed mesothoracic vestiture and a uniformly microareolate mesopleuron and propodeum, including hindface (mesothoracic vestiture is also appressed in *musciventris*, *tarsatus*, *williamsi*, and many *antennatus*, but their thorax is differently sculptured). Sternum II of the female is uniformly micropunctate, including the apical depression (the only such case in North American *Tachysphex*). The absence of a glabrous clypeal bevel in some females is also diagnostic (Fig. 33a). The male differs from *musciventris* and *antennatus* in having an arcuate, moderately broad clypeal lip (lobe triangular in *musciventris*, unusually broad in *antennatus*), and from *tarsatus* and *williamsi* in having appressed sternal setae.

DESCRIPTION.—Frons opaque, finely punctate (punctures subcontiguous) to irregularly microrugose. Vertex finely, evenly punctate, punctures less than one diameter apart, often subcon-

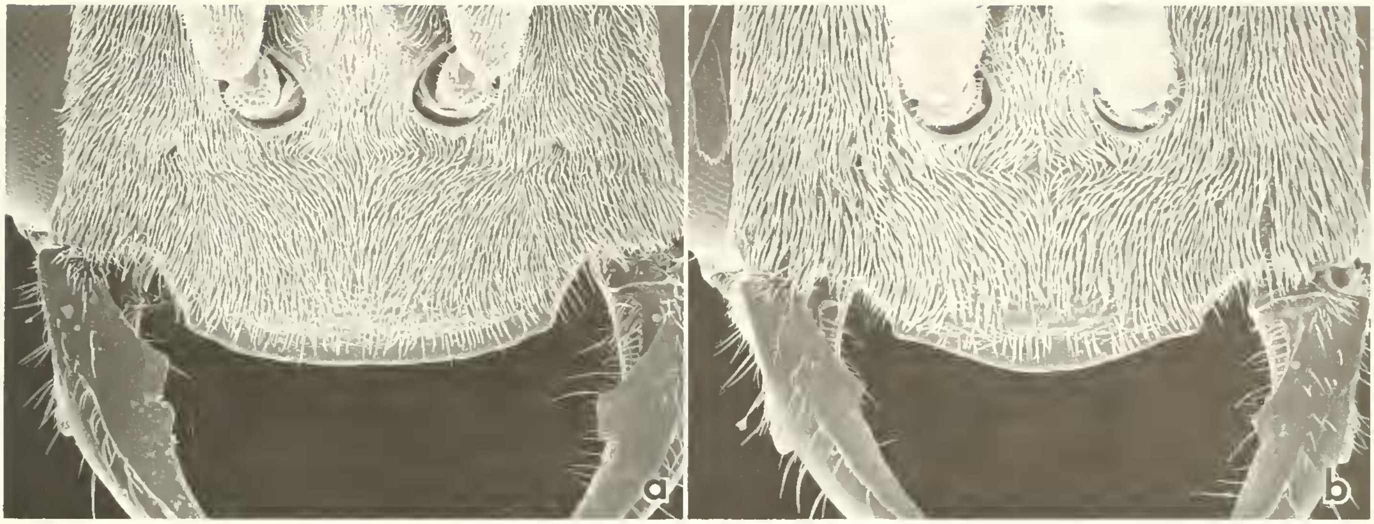

FIGURE 33. *Tachysphex laevifrons* (F. Smith): a—female clypeus; b—male clypeus.

tiguous. Mesopleuron and all propodeum opaque, evenly microareolate. Discal micropunctures of tergum II less than one diameter apart. Hindcoxa not carinate.

Vestiture short, decumbent on frons, mesothorax, and femora. Vertex setae appressed, but erect (about 1.0 MOD long) on postocellar impression in some populations. Middle scutal setae oriented posterad.

Head, thorax, and legs black, tarsal apex brownish. Terga I–III red (sometimes I and II only), usually also corresponding sterna; remainder black; terga I–IV silvery fasciate apically. Wings weakly infumate. Frontal vestiture silvery.

♀.—Clypeus (Fig. 33a): bevel absent to about as long as basomedian area; lip arcuate, without mesal notch or lateral incisions. Dorsal length of flagellomere I 1.8–2.0× apical width. Vertex slightly narrower to slightly wider than long. Sternum II densely punctate throughout, sometimes also sternum III; tergum V densely punctate, including apical depression. Forefemoral and trochanteral venter finely, evenly punctate, punctures less than one diameter apart. Length 7–10 mm.

Vestiture partly obscuring integument between antennal socket and orbit.

♂.—Inner mandibular margin with tooth (Fig. 33b). Clypeus (Fig. 33b): bevel absent; lip broadly arcuate, its corners obtuse, much closer to orbit than to each other. Dorsal length of flagellomere I 1.1–1.2× apical width. Vertex width 1.6–1.7× length. Sterna densely punctate throughout. Forefemoral notch almost glabrous. Foretarsus with rake; outer apical spine of foretarsomere II equal to tarsomere III or longer. Length 6.0–7.5 mm.

Frontal vestiture weak to dense, integument visible or obscured between antennal socket and orbit.

VARIATION.—Specimens from the Carolinas and Florida have an opaque, uniformly microsculptured scutum; the setae on the postocellar impression are erect, about 1.0 MOD long. Individuals from Kansas, Oklahoma, and Texas usually have the scutum finely, very closely punctate, and the setae on the postocellar impression are appressed. The latter population could be called *laevifrons leensis* by those who accept trinominal nomenclature.

LIFE HISTORY.—Females of *laevifrons* nest in flat or slightly sloping sand and prey on immature *Melanoplus* (Acrididae) according to Krombein (1967). There is one generation per year (Kurczewski 1971), and the nest is unicellular (Kurczewski 1966*b*). Kurczewski (1966*b*) also noted that the species is not gregarious and that territoriality was not apparent between males.

GEOGRAPHIC DISTRIBUTION (Fig. 36).—United States east of 100th meridian, north to North Carolina and Kansas; it replaces *tarsatus* in the southeast.

MATERIAL EXAMINED.—74♀, 29♂ (BMNH, CAS, CU, FSCA, GEB, INHS, KU, MCZ, NYSU, TAI, UCD, UCR, UGA, USNM).

RECORDS.—UNITED STATES: FLORIDA: **Alachua:** Alachua, Gainesville, 6 mi S La Crosse, Monteoca (11 mi NW Gainesville). **Clay:** Camp Crystal. **De Soto:** Arcadia. **Duval:** Jacksonville, including St. John's Bluff. **Highland:** Lake Placid. **Lake:** —. **Orange:** Orlando. **Putnam:** Welaka. **Suwannee:** Suwannee River State Park. **Taylor:** Perry. KANSAS: **Barton:** —. **Stafford:** Salt flats area. NORTH CAROLINA: **Cumberland:** Fort Bragg. **Dare:** Nag's Head. **Moore:** Southern Pines. OKLAHOMA: **Beaver:** Forgan. SOUTH CAROLINA: **Georgetown:** 6 mi SSW Murrell's Inlet. TEXAS: **Kenedy:** 3 mi S Sarita. **Kleberg:** 6 mi E Riviera. **Lee:** Fedor. **Victoria:** Victoria.

Tachysphex tarsatus (Say)

(Figures 34–36)

Larra tarsata Say, 1823:78, sex not indicated. Holotype or syntypes, Arkansas: no specific locality (destroyed, see W. Fox 1902:11).—F. Smith 1856:281, Cresson 1862:237, Riley 1880:270, Patton 1881:389, Ashmead 1890:33.—In *Larrada* Cresson 1865:464, 1876:208.—In *Tachysphex* W. Fox 1894*a*:512, 1894*b*:106, Dalla Torre 1897:685, Ashmead 1899:250, J. Smith 1900:518, Peckham and Peckham 1900:89, 1905:261, H. Smith 1908:381, J. Smith 1910:683, Rohwer 1911:580 (in key), Williams 1914:165, 203, Rohwer 1916:687; Stevens 1917:422; Mickel 1918:422, Bradley 1928:1009; Robertson 1928:128, 195, Brimley 1938:443, Strickland 1947:129; Krombein 1950:267; G. Bohart 1951:952, Cooper 1953:33, Krombein 1953*a*:330, Kurczewski and Kurczewski 1963:146; Kurczewski 1966*b*:436–453, Krombein 1967:393, Evans 1970:490; Alcock and Gamboa 1975:164, Bohart and Menke 1976:277; Krombein 1979:1630; Steiner 1981:333, 1982:2, 12–14, Finnamore 1982:106, Elliott and Kurczewski 1985:293; Rust et al. 1985:46.

DIAGNOSIS.—Females of *tarsatus* and *williamsi* cannot be distinguished from one another. Both have appressed mesopleural setae, including hypoepimeral setae (Fig. 34b). Appressed setae also occur in *laevifrons*, *musciventris*, some *antennatus*, and some *crassiformis*, which have distinctive characters easily separating them from *tarsatus* and *williamsi*. Differences in geographic distribution aid in the identification of *tarsatus* and

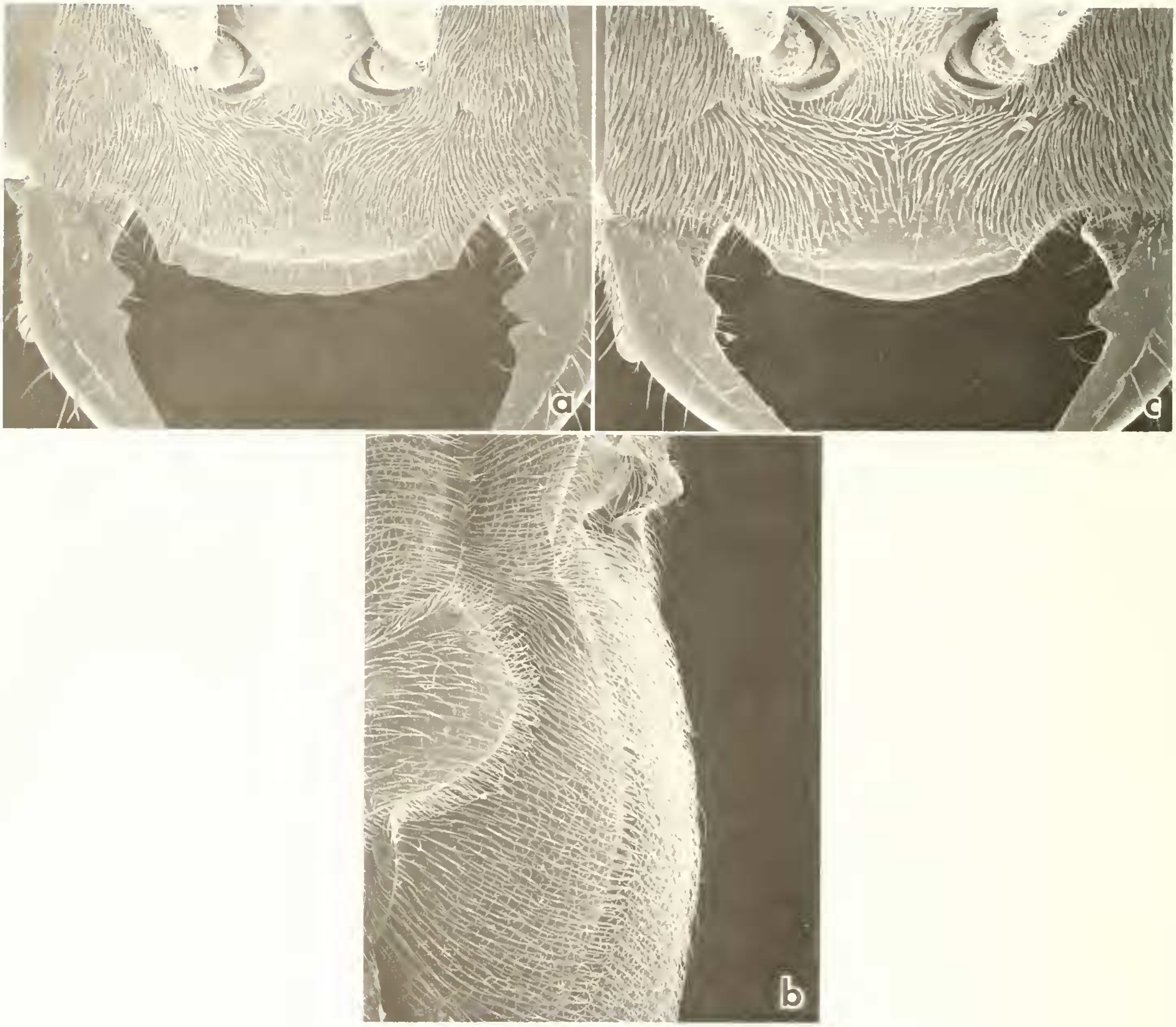

FIGURE 34. *Tachysphex tarsatus* (Say). a—female clypeus, b—female mesopleuron, front view, c—male clypeus.

williamsi. Both occur between the West Coast and the 100th meridian, but only *tarsatus* ranges between the 100th meridian and the East Coast and on the California Channel Islands (see also Discussion under *williamsi*).

The male of *tarsatus* has distinctive, suberect setae, about 1.0 MOD long, on sterna VI–VIII (Fig. 35a, b), and sinuous setae on the volsella and gonoforceps (Fig. 35c–g). In other species of the *pompiliformis* group, the sternal setae are appressed or nearly so (except in *williamsi* where they are erect, no longer than 0.4 MOD on sterna VI and VII), and the setae are straight on the volsella and gonoforceps.

DESCRIPTION.—Punctures shallow, subcontiguous on frons, less than to about one diameter apart on vertex, subcontiguous on scutum. Mesopleuron mat, granulose microrugose. Propodeal dorsum evenly microreticulate; side mat, finely ridged or uniformly microsculptured; hindface ridged, rarely uniformly microreticulate. Sternum I without apical depression. Micropunctures of tergum II two to three diameters apart. Hindcoxa not carinate.

Vestiture totally (male) or largely (female) obscuring sculpture between antennal socket and orbit. Vertex setae suberect, about 0.5 MOD long; scutal, mesopleural (Fig. 34b), and femoral setae appressed, but in occasional specimens subappressed just below subalar fossa.

Head, thorax, and legs black, tarsal apex reddish. Gaster red to black (see Variation below). Terga I–IV silvery fasciate apically. Wings moderately infumate to subhyaline. Frontal vestiture silvery.

♀.—Clypeus (Fig. 34a): bevel shorter than basomedian area; the latter with usual dense punctation, and also with large, sparse, shallow punctures; lip arcuate, in most specimens incised laterally, very rarely with vestigial, mesal notch. Dorsal length of

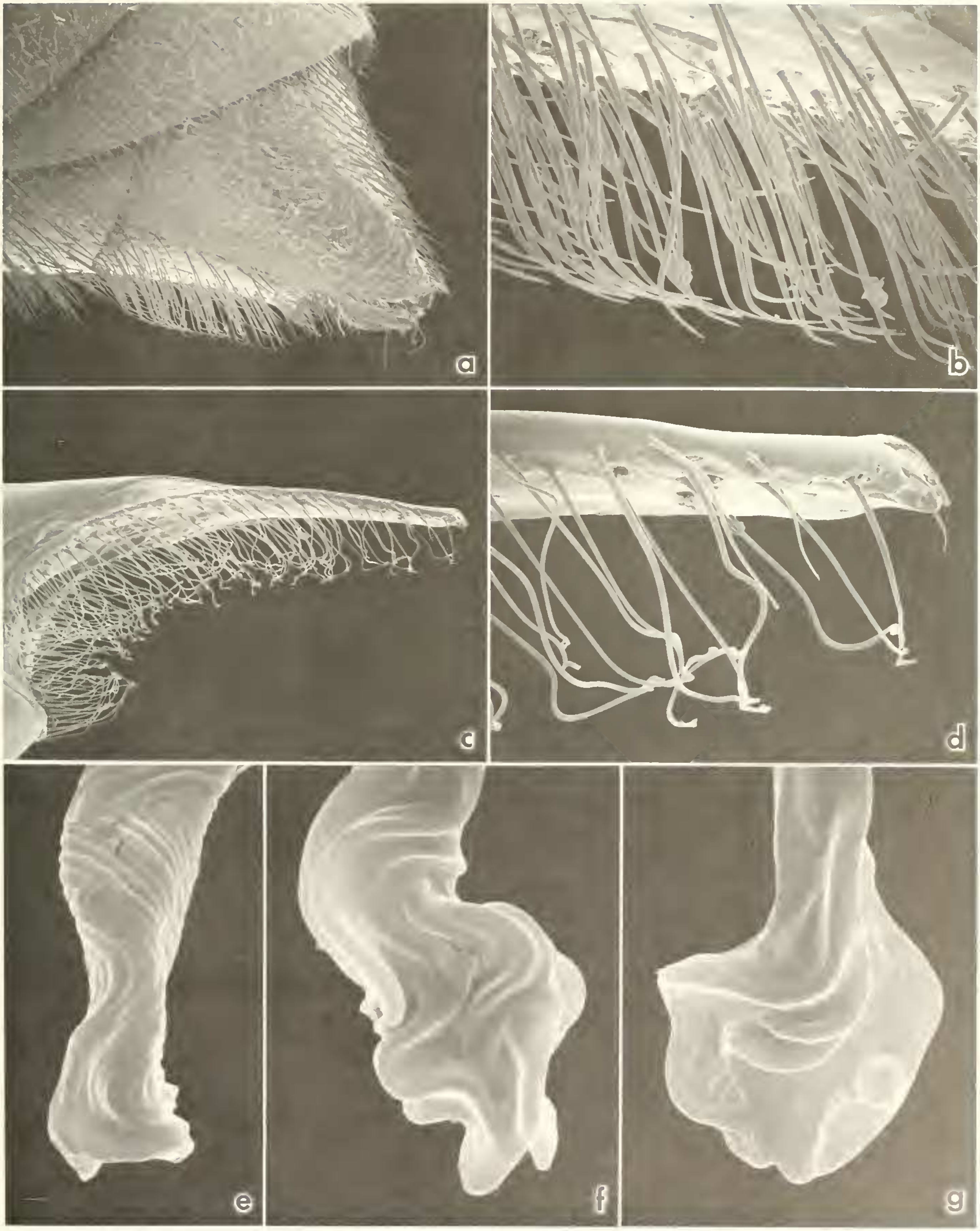

FIGURE 35. *Tachysphex tarsatus* (Say), male: a—gastral apex, b—setae of sternum VII; c—gonoforceps, d—apex of gonoforceps; e–g—setae of gonoforceps.

flagellomere I 2.0–2.5 × apical width. Vertex as wide as long or slightly wider. Tergum V finely, densely punctate (somewhat sparsely in the middle), its apical depression impunctate. Pygidial plate shiny, punctate. Trochanteral and femoral punctation fine, dense. Length 6.5–10.0 mm.

♂.—Mandible with tooth on inner margin (Fig. 34e). Clypeus (Fig. 34e): bevel much shorter than basomedian area; lip arcuate, its corners obtuse, closer to orbit than to each other. Dorsal length of flagellomere I 1.3–1.7 × apical width. Vertex width 1.3–1.6 × length. Sterna densely punctate. Setae of apical sterna: Figure 35a, b. Forefemoral notch glabrous. Foretarsus with none to three preapical rake spines; outer apical spine of foretarsomere II shorter than foretarsomere III, but equal to this tarsomere length in one of the males from Tombstone area, Arizona. Length 5.5–7.0 mm. Gonoforceps and its setae: Figure 35c–g.

Sterna VI–VIII with dense, suberect setae whose length is about 1.0 MOD.

Variation.—The female gaster is red west of the 100th meridian, but tergum V and or IV is darkened in many specimens from British Columbia and Alberta, and all gaster is black in specimens from Arcata (some specimens), Samoa, San Miguel Island, and San Nicolas Island, California, and Couperville and Friday Harbor, Washington. In most females the gaster is marked with black east of 100th meridian: tergum IV is black in most United States specimens, and terga IV and V are black in individuals from Ontario. However, the black covers terga IV–VI in certain specimens from Ontario, New England, Michigan, and North Carolina.

In most males, terga IV–VIII are black, but in some eastern specimens terga I–III also may be largely black. The gaster is all red in specimens from California, Oregon, Idaho, Arizona, and in many specimens from Utah and Colorado. It is black in a male from Andover, Massachusetts (MCZ), three males from Samoa dunes, California (UCD, UIM), all males examined from San Miguel Island and San Nicolas Island, California, a male from Florence, Oregon (OSU), and a male from Couperville, Washington (OSU).

Discussion.—The holotype (or syntypes) of *tarsatus* was lost (Fox 1902), and the original description is so inadequate that the species cannot be recognized with certainty. Therefore, I have followed the traditional interpretation of *tarsatus*. I have not designated a neotype, because suitable specimens from Arkansas were unavailable.

Life History.—Robertson (1928) found *tarsatus* on flowers of *Chamaecrista fasciculata* (Michx.) Greene (as *Cassia chamaecrista* (L.)) and *Cicuta maculata* L. Kurczewski (1966*b*) did not observe gregarious nesting, but I frequently saw aggregations of individuals. The nest is unicellular and permanently open during the provisioning period (Williams 1914; Evans 1970; Alcock and Gamboa 1975). The burrow is slightly inclined, at most 5 cm long, and the cell is 1–2.5 cm beneath the soil surface. Excavated soil forms a tumulus in front of the entrance. Peckham and Peckham (1900) observed orientation behavior (both walking and flying) after completion of a nest. The nest is provisioned with grasshoppers, in most cases *Melanoplus*, but also with Oedipodinae or Acridinae. Elliott and Kurczewski (1985:293) report *Dissosteira carolina* (Linnaeus), *Melanoplus complanatipes* Scudder, *Orphulella pelidna* (Burmeister), and *Pseudopomala brachyptera* (Scudder), and Rust et al. (1985) report *Camnula pellucida* (Scudder). Most prey are nymphs, but the single individual of *Orphulella pelidna* was an adult. Riley (1880) reported that *tarsatus* preyed on the Rocky Mountain grasshopper, *Melanoplus spretus* (Walsh), but his wasp determination is dubious. Steiner (1981) established that four stings are used to paralyze the prey and described stinging sites on the prey's body. When carrying a prey, the female straddles it and holds its antennae with her mandibles (Williams 1914). His description suggests that the prey is kept venter up during transportation. Elliott and Kurczewski (1985:293) observed prey carrying females either walking on the ground or moving in a series of short flights. The prey may be brought directly into the burrow or (Williams 1914) first deposited at the entrance. In the latter case, the wasp enters the nest, turns around inside the nest, reappears headfirst, seizes the grasshopper by its antennae, and drags it backward into the burrow. The prey is deposited in the cell, venter up and head in, and the egg of the wasp is placed across the host's prosternum. The prey may be longer than the female or considerably smaller (in which case two prey per nest are supplied). Peckham and Peckham (1900) observed that the egg was not laid on the first prey brought in to the nest. To close the nest, the female gets up on the tumulus and backs several times into the entrance, pushing the earth in with her forelegs. She uses her pygidial area to tamp in the soil.

Williams (1914) also reported an unidentified sarcophagid fly that follows wasps carrying prey. These flies larviposit on the acridids deposited at the nest entrance.

Kurczewski (1966*b*) found that males usually frequent several perches, and occasionally one may chase another from a perch. They spend nights and inclement weather in burrows that are dug with their mandibles and forelegs. The burrows are closed from within and have no apical cell. Males stay at the end of their burrow, the head toward the entrance. During copulation (Kurczewski 1966*b*), the male mounts the female, and she spreads her wings laterally (at about 40–55° to the main axis of the body). In both cases observed by Kurczewski, the front legs of the male, probably the femora, appeared to hold the foremargin of the female wings (possibly with the forefemoral notches). The male's wings are folded flat over his dorsum during mating.

Geographic Distribution (Fig. 36).—Southern Canada to Georgia and Costa Rica; replaced by *laevifrons* in southeastern United States.

Material Examined.—1,403♀, 1,562♂, and also 720♀ which may be either *tarsatus* or *williamsi*.

Records.—CANADA. **Alberta:** Drumheller, 5 mi S Irvine, Lethbridge, Medicine Hat, Scandia. **British Columbia:** Okanagan Falls, Olivier, 4 mi S Princeton, Richter Pass Road (7 mi W Osoyoos), Robson, Summerland, Vernon. **Manitoba:** Aweme, Bald Head Hills (13 mi N Glenboro), Stockton. **Ontario:** Belleville, Brighton, Chatterton, Jordan, Merivale, Ottawa, Point Pelee. **Quebec:** Hull, Notre Dame du Portage. **Saskatchewan:** Christopher Lake, 10 mi W Moose Jaw, Prince Albert, Saskatoon, Swift Current, Willow Bunch.

UNITED STATES. ALABAMA. **Lee:** Auburn. ARIZONA. **Cochise. Coconino:** Flagstaff, Grand Canyon National Park. **Graham:** Roper Lake State Park. **Maricopa:** 3 mi SW Wickenburg. **Mohave:** 15 mi S Wikieup. **Navajo:** Jadito Trade Post, 16 mi SW Kayenta. **Pima:** Sahuarita, Santa Rita Mts., 10 mi SE Tucson. **Santa Cruz.** ARKANSAS. **Marion:** —. CALIFORNIA. **Alameda. Alpine. Butte:** 13 mi N Chico, Paradise. **Contra Costa. Del Norte:** Southern Fork of Smith River. **El Dorado. Fresno:** Fresno. **Humboldt. Inyo. Kern:** Antelope Canyon near Tehachapi, Cerro Noroeste (SW corner of county), Mill Potrero. **Lake:** Cobb. **Lassen. Los Angeles. Madera:** 11 mi N Fresno. **Marin. Mariposa:** El Portal, Mariposa. **Mendocino. Merced:** Dos Palos. **Modoc. Mono. Monterey. Napa. Nevada. Orange:** Fullerton, Santa Ana Canyon. **Placer. Plumas. Riverside. Sacramento:** Sacramento. **San Benito:** Idria (Gem Mine), Pinnacles National Monument. **San Bernardino:** Baldy Mesa, 1 mi W Cajon, 8 mi NE Cima, 2 mi W Phelan, Victorville. **San**

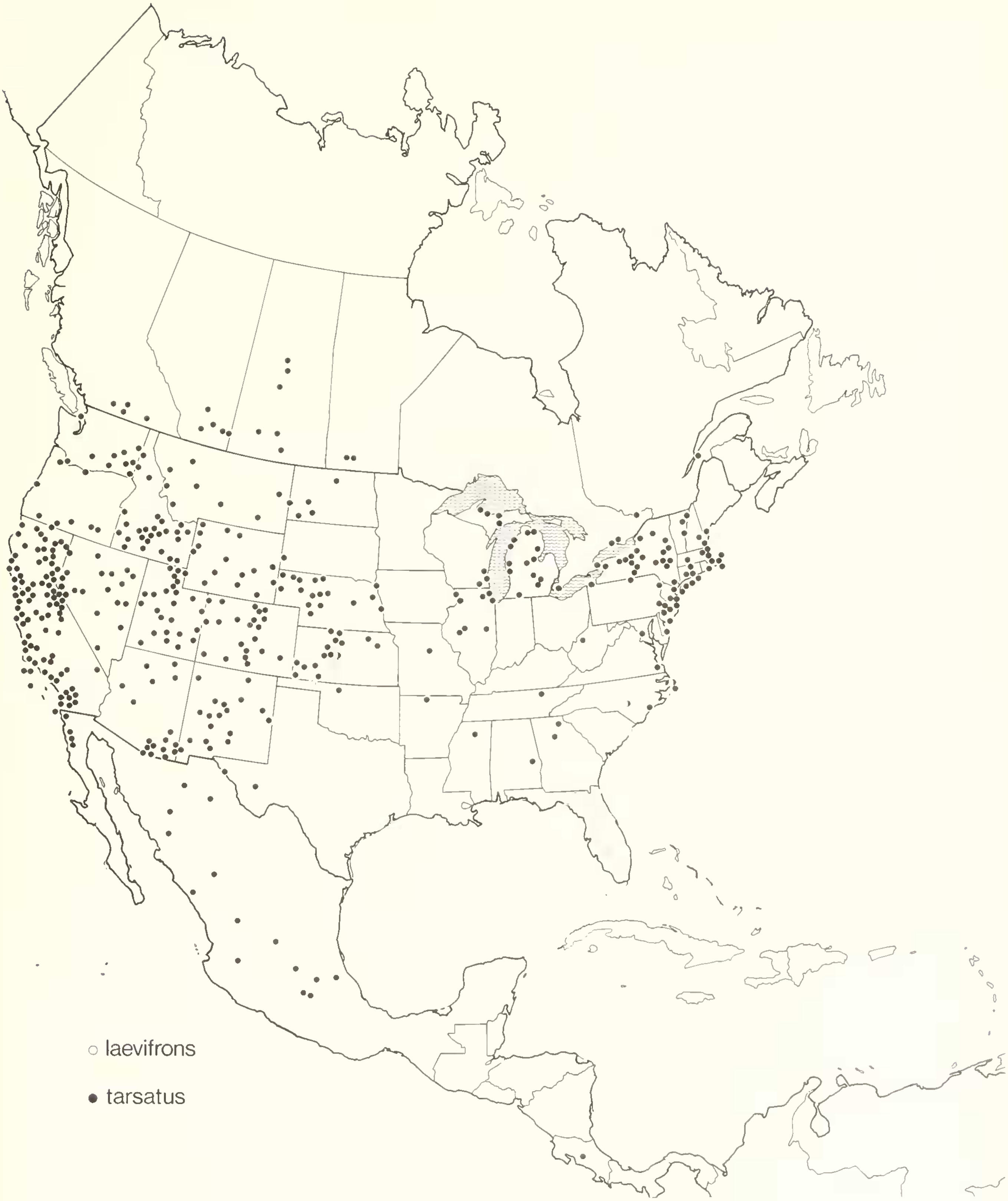

FIGURE 36. Geographic distribution of *Tachysphex laevifrons* (F. Smith) and *tarsatus* (Say).

Diego. **San Francisco:** San Francisco (Presidio Park). **San Joaquin:** Bacon Island, Stockton, Tracy. **San Luis Obispo. San Mateo:** Menlo Park, Redwood City. **Santa Barbara:** Bluff Camp, Goleta, Refugio Pass, San Miguel Island, Santa Cruz Island, Santa Rosa Island, Santa Ynez Mts. **Santa Clara:** Alum Rock Park, San Jose, Stanford University. **Santa Cruz:** Soquel. **Shasta. Sierra. Siskiyou. Solano:** Benicia State Recreation Area (3 mi SE Vallejo), Vallejo. **Sonoma:** Guernewood Park along Russian River. **Trinity:** Hayfork Ranger Station. **Tulare:** 8 mi NE Three Rivers. **Tuolumne. Ventura:** Foster Park, San Nicolas Island, Sespe, Wagon Road No. 2 Campground (18 air mi WSW Gorman). **Yolo:** Davis. COLORADO: **Alamosa:** Great Sand Dunes National Monument. **Bent:** Hasty. **Boulder. Chaffee:** Poncha Springs, Salida. **Clear Creek:** Mt. Evans (Doolittle Ranch), Oslar. **Costilla:** Ute Creek. **Custer:** Alvarado Creek (Sangre de Cristo Mts.). **Denver:** Denver. **Douglas:** 20 mi S Denver. **Eagle:** State Bridge. **Garfield:** Rifle. **Gilpin:** S Central City. **Huerfano:** Gardner. **Jefferson:** Golden. **Larimer. Mesa:** 31 mi N Mack, Mesa area. **Moffat:** Craig, Dinosaur National Park. **Montezuma:** 3 mi W Arriola. **Pueblo:** Pueblo. **Rio Blanco:** 23 mi S Becker. **Rio Grande:** South Fork. **Teller:** Florissant. **Weld:** Keenesburg, Owl Creek (12 mi NE Nunn), Roggen. CONNECTICUT: **Hartford:** E Hartford. **Middlesex:** Durham. **New Haven:** Bethany, 2 mi E Seymour. DELAWARE: **Sussex:** Lewes. DISTRICT OF COLUMBIA: Washington. GEORGIA: **De Kalb:** Stone Mountain (1♀, UGA). **White:** Cleveland (1♀, UGA). IDAHO: **Ada:** 10 mi S Boise. **Blaine:** 9 mi SW Bellevue, 2 mi W Carey (also 3 mi NW). **Bonneville:** 5 mi W Idaho Falls. **Butte:** Craters of the Moon National Monument. **Camas:** 12 mi S Fairfield (also 23 mi E), 8 mi W Hill City. **Cassia:** 9 mi E Malta. **Clark:** Blue Dome. **Custer:** Lost River Mts., Salmon River (2 mi S Challis). **Elmore:** Dixie. **Franklin:** 5 mi NE Minkcreek, Preston, Thomas Springs. **Fremont:** Saint Anthony Sand Dunes. **Gooding:** 5 mi N Bliss, 1 mi N Gooding (also 12 mi N). **Idaho:** 10 mi NE Lowell. **Jefferson:** 3 mi N Terreton. **Kootenai:** 12 mi N Worley. **Latah:** Moscow. **Lincoln:** Shoshone (also 19 mi N). **Oneida:** Black Pine Canyon 5 mi NW Holbrook, Twin Springs. **Owyhee. Payette:** —. **Twin Falls:** Hollister. ILLINOIS: Chicago. **Champaign:** Urbana. **McHenry:** Algonquin. **Kane:** near Camp Big Timber. **Lake:** Lake Forest. **Mason:** Bath, Havana (Devils Neck), Sand Ridge State Forest. **Whiteside:** Fulton. IOWA: **Jackson:** Bellevue. **Woodbury:** Sergeant Bluff, Sioux City. KANSAS: **Clay:** Clay Center. **Gray:** Cimarron. **Pottawatomie:** Blackjack Creek. Also **Barton, Grant, Hamilton, Meade, Morton, Ness, Norton, Osborne, Phillips, Rooks, Rush, Trego:** —. MAINE: **York:** 4 mi SW Kennebunk, Limington. MARYLAND: **Prince Georges:** Beltsville. MASSACHUSETTS: Boston. **Barnstable:** Provincetown, Sagamore, Wellfleet. **Dukes:** Nonamesset Island. **Essex:** Andover, Lynn. **Hampden:** Holyoke. **Hampshire:** Southampton. **Middlesex:** Bedford, Lexington. **Norfolk:** Needham, Wellesley. **Plymouth:** Manomet. MICHIGAN: **Alger:** Pictured Rocks National Lakeshore. **Benzie:** —. **Cheboygan:** Cheboygan, Douglas Lake. **Clinton:** Rose Lake. **Delta. Isabella. Leelanau:** —. **Livingston:** E. S. George Reserve. **Marquette:** Huron Mountain Club, Marquette. **Midland:** —. **Muskegon:** Muskegon County Park. **Oceana:** Claybank Township Park. **Ogemaw:** —. **St. Joseph:** Mohney Lake. **Washtenaw:** Pinckney State Recreation Area near Half Moon Lake. MISSISSIPPI: **Lafayette:** Oxford. MISSOURI: **Boone:** Columbia. MONTANA: **Beaverhead:** 3 mi W Jackson. **Dawson:** Glendive. **Lewis and Clark:** Helena. **Ravalli:** Hamilton (Rocky Mountain Laboratory). **Rosebud:** Ashland. **Sanders:** Dixon. **Sweet Grass, Teton:** —. NEBRASKA: **Blaine:** 5 mi N Chinook, Dunning, Halsey. **Cherry:** 10 mi N Nenzel (on Niobrara River), Valentine. **Cuming:** West Point. **Dawes:** Chadron. **Douglas:** Omaha. **Hooker:** 1.5 mi N Mullen. **Keith:** Ogallala. **Lincoln:** North Platte, Wallace. **Nance:** Genoa. **Scotts Bluff:** 8 mi S Gering, Mitchell. **Sheridan:** Bingham, Rushville. **Sioux:** Glen, Monroe Canyon, Sawbelly, Toadstool Park (18 mi N Crawford). **Thomas:** Thedford. NEVADA: **Douglas:** 4 mi NE Glenbrook, Minden. **Elko. Esmeralda:** Walker Springs. **Eureka:** 1 mi W Emigrant Pass, 14 mi W Eureka. **Humboldt:** Canyon Creek, Orovada. **Lincoln:** Highland Range near Mendha. **Lyon:** Sweetwater. **Mineral:** 4.5 mi S Schurz. **Nye. Washoe. White Pine:** Charcoal Oven State Park, 10 mi NW Preston. NEW HAMPSHIRE: **Belknap:** Lake Winnipesaukee. **Rockingham:** Hampton, Salem. NEW JERSEY: **Bergen:** Closter. **Burlington:** Browns Mills, Lebanon State Forest, Riverton. **Camden:** Atco, Clementon. **Cape May:** Reeds Beach, Sea Isle City. **Gloucester:** —. **Mercer:** Princeton. **Monmouth:** Little Silver, Ocean Township, Tinton Falls. **Ocean:** Lakehurst, Point Pleasant. NEW MEXICO: **Bernalillo:** Albuquerque. **Catron.** Pie Town. **Colfax:** 2 mi N Ute Park. **Dona Ana:** 5 mi E Las Cruces. **Grant:** 1 mi S Silver City. **Hidalgo:** 15 and 21 mi S Animas, Rodeo (also 7 mi SE). **Lincoln:** Alto. **Otero:** Alamogordo. **Quay:** Tucumcari. **Roosevelt:** Oasis State Park. **San Juan:** Newcomb. **San Miguel:** Las Vegas. **Sierra:** Percha Dam State Park. **Socorro:** La Joya (20 mi N Socorro), 16 mi W Magdalena, 37 mi S Socorro. **Torrance:** Tajique. **Valencia:** 3 mi E Laguna. NEW YORK: **Albany. Cayuga:** Auburn, Fair Haven. **Erie:** Buffalo. **Fulton:** Broadalbin. **Jefferson:** road 37 W Theresa. **Madison:** Chittenango. **Monroe:** Irondequoit, Mendon Ponds, Rochester. **Nassau:** Long Beach, North Bellmore. **Oswego:** Granby Center, Mallory, Oswego. **Otsego:** Cooperstown. **Saint Lawrence:** Wanakena. **Saratoga:** Middle Grove. **Schoharie:** Schoharie. **Suffolk:** Bohemia, Cold Spring Harbor, Coram, Farmingville, Orient, Smithtown. **Tompkins. Warren:** Pottersville. **Wayne:** —. **Westchester:** Peekskill. NORTH CAROLINA: **Dare:** Kill Devil Hills, Nags Head, S Salvo. **Moore:** Southern Pines. **Onslow:** Jacksonville. NORTH DAKOTA: **Bowman:** Bowman. **Golden Valley:** Beach. **Hettinger:** Mott. **McHenry:** Towner. **Stark:** Dickinson. OKLAHOMA: **Woods:** 3 mi W Waynoka. OREGON: **Harney:** Frenchglen, Steen Mts. **Jackson:** Gold Hill, Medford. **Klamath:** Klamath Falls. **Lake:** Chowaucan River. **Lane:** 2 mi S Florence. **Sherman:** Rufus. **Washington:** Cornelius. PENNSYLVANIA: **Bradford:** Wilawana. **Erie:** Erie, Presque Isle State Park. **Montgomery, Pike:** —. RHODE ISLAND: **Newport:** Newport. SOUTH DAKOTA: **Custer:** Black Hill National Forest. TENNESSEE: **Morgan:** Burrville. TEXAS: **Hudspeth:** McNary. **Jeff Davis:** 11 mi NE Fort Davis. **Randall:** Palo Duro Canyon State Park. UTAH: **Box Elder. Cache. Davis:** Farmington. **Duchesne:** Duchesne. **Emery:** N Goblin Valley (Buckskin Spring, Orange Olsen Ranger Station, Wild Horse Creek). **Garfield:** Calf Creek, 24 mi N Panguitch. **Grand:** Capital Reef National Park, Castleton. **Juab:** 5 mi W Callao. **Millard:** Delta, 12 mi N Fillmore, Gandy. **Rich:** Bear Lake. **San Juan:** Kane Springs (E Bridges National Park), 25 mi S Moab. **Summit:** Snyderville. **Tooele:** Simpson Spring, Tooele. **Uintah:** 17 mi S Bonanza. **Utah:** Spanish Fork. **Washington:** Leeds Canyon, Zion National Park. **Wayne:** Grover, Hanksville, Torrey. **Weber:** Eden, Willard Basin. VERMONT: **Caledonia:** W Danville. **Essex:** —. **Orange:** Thetford, Union Village. VIRGINIA: **Fairfax:** Barcraft, Falls Church. **Norfolk:** Norfolk. WASHINGTON: **Adams:** 7 mi N Othello. **Asotin:** Field Springs State Park. **Clark:** Vancouver. **Franklin:** Richland. **Garfield:** Central Ferry. **Grant:** O'Sullivan Dam. **Island:** Coupville. **Lincoln:** Odessa. **San Juan:** San Juan. **Spokane:** Mead. **Whitman:** Pullman, Wawawai (also 2 mi E). **Yakima:** Yakima. WEST VIRGINIA: **Wirt:** —. WISCONSIN: **Milwaukee:** Milwaukee. **Walworth, Washington:** —. WYOMING: **Albany:** Laramie, Summit. **Big Horn:** 10 mi E Shell. **Carbon:** Rawlins. **Converse:** Glenrock. **Fremont:** Riverton. **Goshen:** Torrington. **Lincoln:** Etna. **Natrona:** Pathfinder Dam (8 air mi SW Alcova). **Niobrara:** —. **Park:** Powell. **Sweetwater:** 20 mi E Farson, Green River (also 15 mi S). **Teton:** 5 mi S Elk Post Office, Hoback Junction, Jackson Hole.

MEXICO: **Baja California Norte:** S Coronado Island, Descanso, 10 mi S San Quintin, Santo Domingo area, San Vicente. **Chihuahua:** 35 mi N Chihuahua, Mesa del Huracán (30°04′N, 108°15′W). **Distrito Federal:** Porto de las Cruces. **Durango:** Rodeo. **Hidalgo:** 5 mi W Pachuca. **Jalisco:** Guadalajara, 8 km E Ojuelos. **Mexico:** Tepexpan. **Puebla:** 14 mi W Huachinango. **Queretaro:** Palmillas. **Sinaloa:** 8 mi SE Elota. **Sonora:** Alamos, E Yaqui River (35 air km WSW Sahuaripa). **Zacatecas:** 2 km SW Valparaiso.

COSTA RICA: **San Jose:** San Antonio de Escazu.

Tachysphex williamsi R. Bohart

(Figures 37, 38)

Tachysphex williamsi R. Bohart, 1962:38, ♀, ♂ ! Holotype: ♂, California: San Francisco, Lone Mt. (CAS).—Krombein 1967:394; Bohart and Menke 1976:277; Krombein 1979:1630; Elliott and Kurczewski 1985:294.

Diagnosis.—The female of *williamsi* cannot be distinguished from *tarsatus*, but details of geographic distribution help in identification (see *tarsatus* for more information). The male has distinctive straight setae on sterna VI–VIII, up to 0.4 MOD long (Fig. 37), and setae on the volsella and gonoforceps are straight also. In *tarsatus*, the sternal setae are curved apically, about as long as MOD, and those on the gonoforceps and volsella are sinuate, thickened apically.

Description.—Punctures subcontiguous on frons, vertex, and scutum. Frontal punctures shallow. Mesopleuron mat, microrugose, or with shallow, inconspicuous punctures. Propodeal dorsum evenly microareolate; side opaque, uniformly microsculptured or finely, irregularly ridged; hindface ridged, but almost uniformly microsculptured in occasional specimens. Sternum I without apical depression. Discal micropunctures of tergum II one to three diameters apart. Hindcoxa not carinate.

Setae appressed on vertex or (some specimens) erect, about 1.0 MOD long; appressed on scutum, mesopleuron, and femora.

Head, thorax, and legs black, tarsal apex sometimes reddish. Gaster red or black. Wings subhyaline to infumate. Terga I–III (female) or I–IV (male) silvery fasciate apically.

♀.—Clypeus: bevel shorter than basomedian area; the latter with usual, dense punctation, and also with large, sparse, shallow punctures; lip arcuate, indented laterally. Dorsal length of flagellomere I 1.8–2.3× apical width. Vertex as wide as long or slightly wider. Tergum V sparsely punctate mesally, its apical depression impunctate. Pygidial plate shiny, punctate. Trochanteral and femoral punctation fine, dense, but mid- and hindtrochanteral venter often sparsely punctate. Length 8–10 mm.

Integument not obscured by vestiture between antennal socket and orbit.

♂.—Mandibular inner margin with tooth. Clypeus: bevel much shorter than basomedian area; lip arcuate, its corners rectangular or obtuse, closer to orbit than to each other. Dorsal length of flagellomere I 1.4–1.6× apical width. Vertex width 1.3–1.6× length. Sterna densely punctate. Sternal setae: Figure 37. Forefemoral notch glabrous. Forebasitarsus with none to three preapical rake spines; outer apical spine of foretarsomere II shorter than foretarsomere III. Length 5.5–8.0 mm.

Integument totally hidden under vestiture between antennal socket and orbit. Sterna I–VI with very short, appressed pubescence; setae of sternum VII and VIII up to 0.4 MOD long.

Variation.—Setae of male sternum VII and VIII varying from very short, nearly appressed, to erect, about 0.4 MOD long. Both extremes may occur within the same population, e.g., in specimens from San Francisco (Lobos Creek, Laguna Puerca).

The gaster is red with black apex in most specimens, but all black in many specimens from California (especially from the coast). In a series from Hasty, Colorado, the gaster is all red in most specimens but all black in some males.

Discussion.—Females of *tarsatus* and *williamsi* seem identical, but males can be separated by abdominal features: the shape and length of setae on sterna VI–VIII, and on the gonoforceps and volsella. R. Bohart (1962) thought that the two species differed in gaster color (all or partly red in *tarsatus*, all black in *williamsi*), but actually both species vary from all red to all black. *Tachysphex tarsatus* is transcontinental and also occurs on the Channel Islands, California, while *williamsi* ranges between the West Coast and the 100th meridian. The status of *tarsatus* and *williamsi* can be interpreted two ways:

1) Both are good species whose females do not differ morphologically. The sternal and genital setae in the male of *tarsatus* are unique within the genus, and no intergradation with *williamsi* has been found.

2) *Tachysphex tarsatus* and *williamsi* represent a single species in which males are dimorphic west of the 100th meridian. Between the West Coast and the 100th meridian males of both types occur together in most localities. However, there are instances where only one type of male occurs (*tarsatus* on the California Channel Islands, *williamsi* in some coastal habitats of central California, e.g., in San Francisco and Marin County). Because of this I have concluded that the first hypothesis is more probable, and I regard *williamsi* as distinct from *tarsatus*.

Life History.—Elliott and Kurczewski (1985:294) recorded a nymph of the acridid *Trimerotropis occidentalis* (Bruner) as prey.

Geographic Distribution (Fig. 38).—Rocky Mountains to the West Coast, south to Baja California Norte; also Saskatchewan, Alberta, and North Dakota.

Material Examined.—54♀, 217♂ (see also figures under *tarsatus*).

Records (b: gaster all black).—CANADA. **Alberta:** Coaldale, Dunmore, Writing-on-Stone Provincial Park. **Saskatchewan:** Regina.

UNITED STATES: ARIZONA: **Cochise:** 5 mi W Portal. CALIFORNIA: **Amador:** Hams Station. **Contra Costa:** Mt. Diablo. **Inyo:** 12 mi E Big Pine. **Lassen:** Hallelujah Junction. **Marin:** Carson Ridge (b), Dillon Beach (b), Point Reyes (b). **Monterey:** Fort Ord. **Nevada:** Prosser Dam. **San Bernardino:** Big Bear Lake, Dollar Lake trail, Holcomb. **San Diego:** Mt. Laguna, Pine Valley, Warner Springs. **San Francisco** (all b except some females from Laguna Puerca partly red): San Francisco (Baker Beach, Ingleside, Laguna Puerca, Lake Merced, Land's End, Lobos Creek, Lone Mt., Presidio Park). **San Mateo:** San Bruno Mts. (b). **Siskiyou:** Macdoel. **Sutter:** Nicolaus (b). COLORADO: **Bent:** Hasty (partly b). **Boulder:** Boulder, Hygiene. **Chaffee:** Buena Vista. **Costilla:** Ute Creek (b). **Denver:** 20 mi S Denver. **El Paso:** Colorado Springs. **Kit Karsoo:** Flagler. **Larimer:** Chimney Rock (60 mi NW Fort Collins, 8,000 ft), Poudre Canyon. **Teller:** Florissant. IDAHO: **Blaine:** 2 mi W Carey. **Butte:** 6 mi S Howe. **Camas:** 23 mi E Fairfield. **Cassia:** 2.5 mi S Malta (also 9 mi E). **Elmore:** Mayfield. **Fremont:** Saint Anthony Sand Dunes. **Gooding:** 1 mi NE Gooding, Hagerman Valley. **Jefferson:** 6 mi N Roberts. **Lincoln:** Dietrich Butte (also 5 mi E), Shoshone. **Oneida:** 5 mi S Holbrook. **Twin Falls:** Castleford, Hollister, Rogerson, Roseworth. MONTANA: **Dawson:** Glendive. **Stillwater:** —. NEBRASKA: **Dawes:** Chadron. **McPherson:** Sandhills. NEVADA: **Elko:** Tuscarora. **Washoe:** 1 mi S Mustang, 15 mi E Reno. **White Pine:** 16 mi S Ely, Lehman Cave. NEW MEXICO: **Catron:** Pie Town. NORTH DAKOTA: **Bowman:** Bowman, Gascoyne. OREGON: **Malheur:** 3 mi S Vale. UTAH: **Box Elder:** Snowville, 12 mi W Tremonton. **Cache:** Cornish. **Uintah:** SW Bonanza. WASHINGTON: **Garfield:** Central Ferry. **Grant:** Sullivan Dam. WYOMING: **Albany:** Laramie. **Big Horn:** Lovell. **Carbon:** Rawlins. **Sweetwater:** Little America.

MEXICO: **Baja California Norte:** El Progreso.

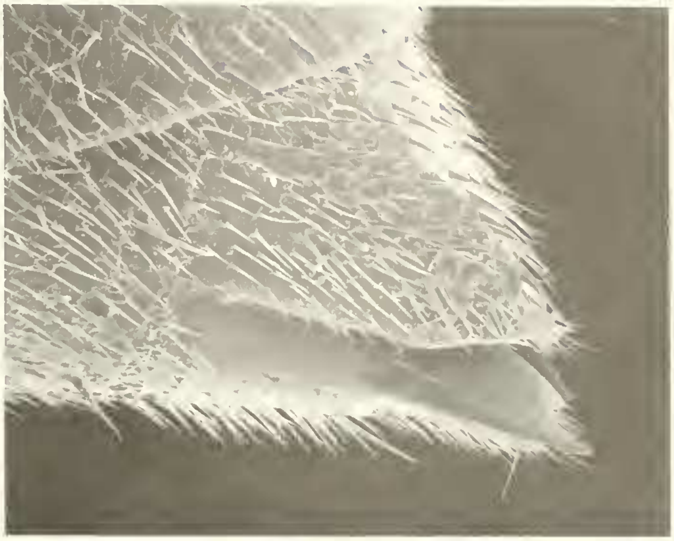

Figure 37. *Tachysphex williamsi* R. Bohart, gastral apex of male.

Tachysphex spatulifer Pulawski

(Figures 39, 40)

Tachysphex spatulifer Pulawski, 1982:35, ♀, ♂! Holotype: ♀, California: Monterey Co.: Arroyo Seco Camp (UCD).

Diagnosis.—*Tachysphex spatulifer* is very similar to *crenulatus*. See the latter species for recognition characters (page 65).

Description.—Punctures less than one diameter apart on frons, scutum, mesothoracic venter, and trochanters. Vertex wider than long. Mesopleuron dull, roughly microsculptured, impunctate. Propodeal dorsum microareolate; side and hindface ridged or (some specimens) microridged. Sternum I without apical depression. Hindcoxa not carinate.

Vestiture totally obscuring integument between antennal socket and orbit. Setae appressed on vertex, scutum, and femora, suberect on hypoepimeral area, subappressed or (some females) suberect below mesopleural scrobe, oriented almost evenly posterad on scutal disk.

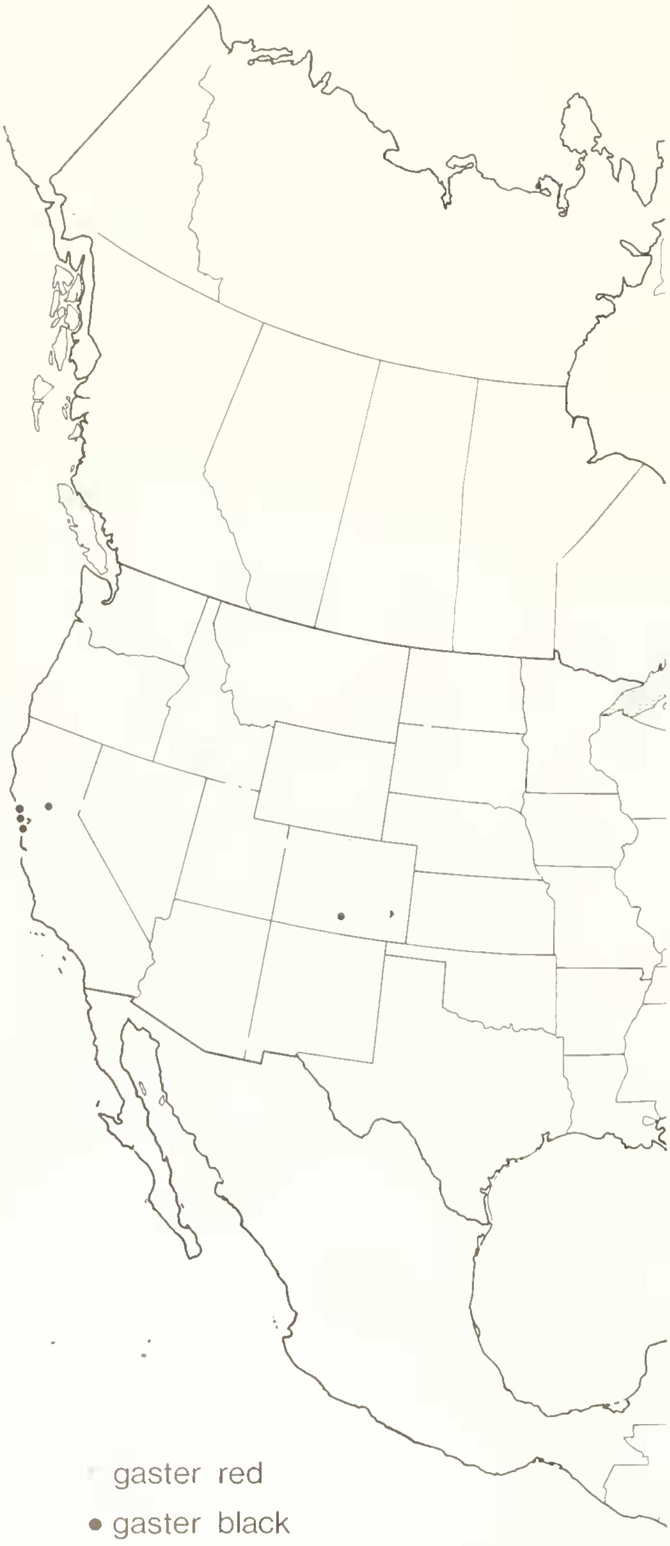

FIGURE 38. Geographic distribution of *Tachysphex williamsi*.

Head, thorax, and legs black, tarsal apex reddish. Wings weakly infumate. Terga I–III indistinctly, silvery fasciate apically (fasciae interrupted mesally).

♀.—Clypeus (Fig. 39a, b): bevel shorter than basomedian area, but sparsely punctate portion of middle section usually longer than densely punctate portion; lip broadened mesally, with one lateral incision, usually variably obtusely dentate (including one median tooth), but sometimes obtusely angulate; lip surface with several shallow, longitudinal, ill-defined furrows. Dorsal length of flagellomere I 2.3–2.7× apical width. Vertex punctures averaging from less than one to about two diameters apart. Tergum V densely or sparsely punctate at middle, its apical depression impunctate. Length 8.0–10.5 mm.

Gaster red. Frontal vestiture silvery or with golden tinge.

♂.—Inner mandibular margin not dentate (Fig. 39c). Clypeus (Fig. 39c): bevel ill defined; free margin very obtusely angulate between lobe and lateral section, apex of angle represented by small tubercle; tubercles usually slightly closer to orbits than to each other (but closer to each other in some specimens); lip obtusely triangular. Dorsal length of flagellomere I 1.4–1.7× apical width. Vertex width 1.2–1.4× length. Vertex punctures no more than one diameter apart. Discal micropunctures of tergum II one diameter apart or less. Sterna finely, evenly punctate, punctures well defined. Forefemoral notch glabrous. Foretarsus without rake; outer apical spine of foretarsomere II shorter than foretarsomere III. Length 5.5–8.0 mm.

Gaster usually bicolored (segments I–II or I–III red, remainder black), but all red in a male from Arroyo Seco, California (UCD) and another from Elba-Basin Pass (UIM). Frontal vestiture golden.

VARIATION.—Gena mostly thick in dorsal view, but thin in a female from Pinyon Flat.

Several males differ in having silvery frontal vestiture, and also:

1) Gena thin in dorsal view, gaster all red. California: Los Angeles Co.: Tanbark Flat, R. C. Bechtel (1♂, UCD); San Bernardino Co.: 10 mi N Lake Arrowhead, P. E. Paige (1♂, UCD), Cajon Junction, E. I. Schlinger (1♂, UCD).

2) Clypeal lip acutely angulate, lip corners slightly closer to each other than to orbits; gaster all red or with black apex. Utah: Weber Co.: Willard Peak, G. Bohart and P. Torchio (2♂, UCD).

These phena may be varieties of *spatulifer* or separate species. Study of topotypical females should solve this problem.

GEOGRAPHIC DISTRIBUTION (Fig. 40).—Washington to California and southwestern Arizona, eastward to southern Idaho and northern Utah.

MATERIAL EXAMINED.—84♂, 140♀ (CAS, CIS, CSDA, FCDA, MCZ, SDNH, TLG, UCD, UCR, UIM, USNM, USU).

RECORDS.—UNITED STATES: ARIZONA: **Yuma:** Colorado City. CALIFORNIA: **Alameda:** Arroyo Mocho (17 mi S Livermore), 1 mi E Mission Peak, Sycamore Grove State Park. **Amador:** Plymouth, Volcano. **Contra Costa:** Las Trampas Ridge (W Danville), Moraga, Mt. Diablo. **El Dorado:** Placerville. **Fresno:** Deer Cove Creek (12 air mi E Hume), Fresno, Warthan Canyon, Watts Valley. **Kern:** Glennville, Tejon Canyon, 1 mi E Woody. **Lake:** Borax Lake near Clearlake Park, N Fork Cache Creek at Highway 20. **Madera:** Buck Camp in Yosemite National Park. **Mariposa:** El Portal, Indian Flat. **Mendocino:** 5 mi N Branscomb, Mendocino. **Monterey:** Arroyo Seco Camp, 5 mi S Jamesburg, Monterey. **Napa:** Samuel Springs (now bottom of Lake Berryessa). **Placer:** 4 mi S Rocklin. **Riverside:** Pinyon Flat (San Jacinto Mts.). **Sacramento:** Folsom (also 10 mi NE), N Sacramento. **San Diego:** La Mesa, Sorrento. **San Luis Obispo:** 2.5 mi Creston, La Panza Camp (12 mi NE Pozo), Pozo (also 3 mi E), 5 mi E Santa Margarita. **Santa Clara:** Los Gatos, Mt. Hamilton. **Sierra:** Independence Lake. **Siskiyou:** Dry Lake Mountain (7 mi NNW town of Klamath River), Windy Camp. **Solano:** Mix Canyon, Pleasants Valley road 5 mi S Highway 128, Vacaville. **Sonoma:** Pepperwood Ranch Natural Reserve (10 mi N Santa Rosa). **Stanislaus:** 3.2 mi W Hwy. 120 on Evergreen Road. **Tulare:** Ash Mt., Camp Wishon (8 air mi NE Springville), Fountain Springs, Porterville, Sequoia National Park, Tule River Indian Reservation, Woodlake.

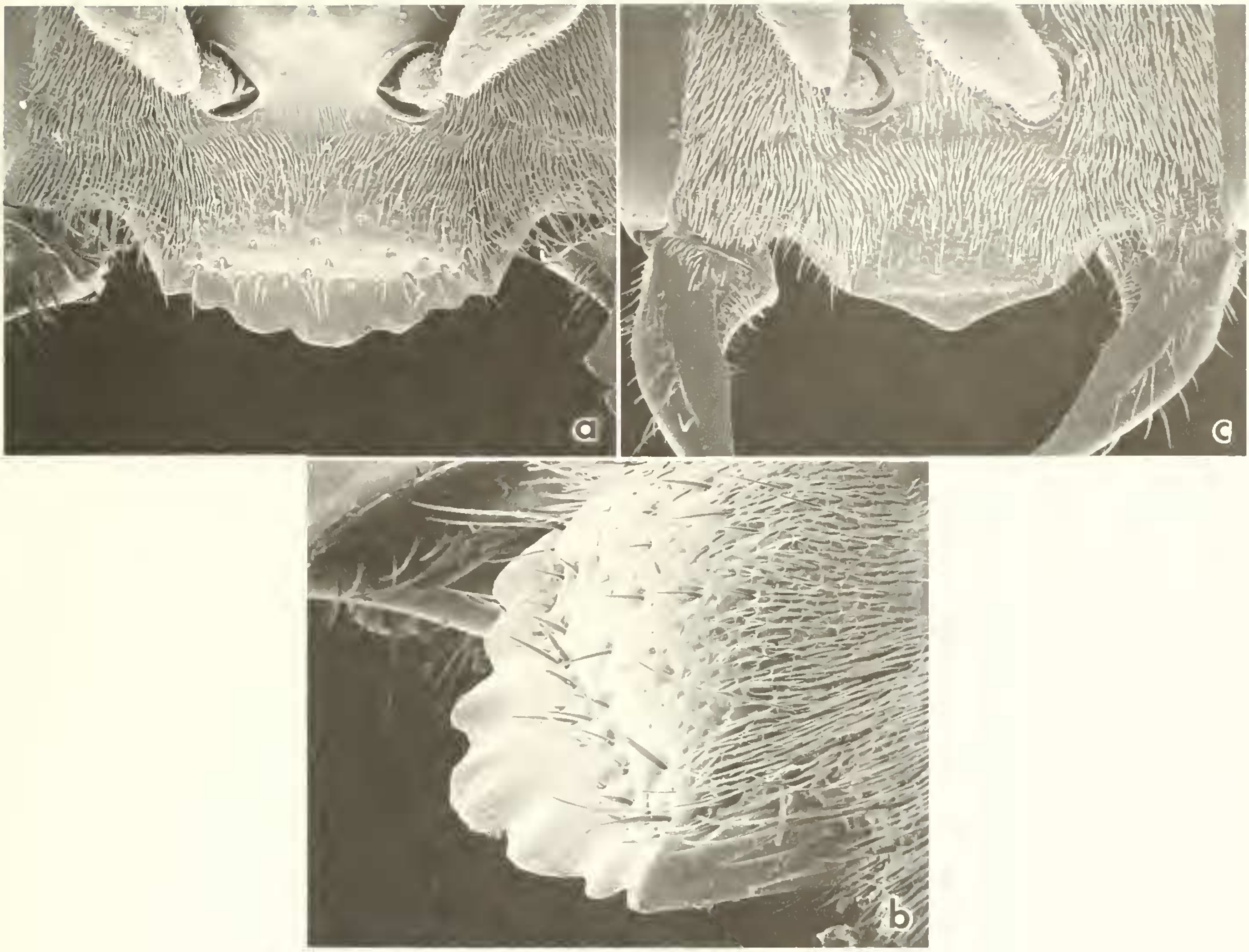

Figure 39. *Tachysphex spatulifer* Pulawski: a—female clypeus; b—female clypeus, oblique view; c—male clypeus.

Tuolumne: Buck Meadows, Mather, 4 mi E Sonora. **Ventura:** Hungry Valley (5 mi S Gorman). **Yolo:** Bear and Cache Creeks junction, Davis, Putah Canyon, Rumsey. IDAHO: **Ada:** Boise. **Cassia:** Elba–Basin Pass. **Fremont:** Saint Anthony Sand Dunes. **Oneida:** Black Pine Canyon. **Washington:** 2 mi N Mann's Creek. NEVADA: **Storey** (formerly Ormsby): Carson City area. OREGON: **Umatilla:** Athena. UTAH: **Cache:** W Hodges Canyon, White Pine Lake near Logan. **Weber:** Willard Peak. WASHINGTON: **Pacific:** Nahcotta.

Tachysphex crenulatus W. Fox

(Figures 41, 42)

Tachysphex crenulatus W. Fox, 1894*a*:512, ♂, ♀. Holotype: ♀, California: no specific locality (ANSP).—Dalla Torre 1897:679, Cresson 1928:44, G. Bohart 1951: 950; Bohart and Menke 1976:273, Krombein 1979:1628.

Diagnosis.—*Tachysphex crenulatus* has an impunctate, uniformly microsculptured mesopleuron. In the female, the clypeal lip has several shallow concavities (Fig. 41b), the lip margin is variously dentate or undulate (Fig. 41a), in most specimens emarginate mesally, and the mid- and hindfemoral venter is sparsely punctate. A similar clypeus is also found in *spatulifer* (in which the clypeal lip has a median projection or is obtusely broadened mesally, and the trochanteral venter is densely punctate), and in *musciventris* (which has a distinctive mesothoracic venter). The male of *crenulatus* has a triangular clypeal lip (Fig. 41c), the midscutal setae are oriented uniformly posterad, and the sterna are uniformly punctured, with nonvelvety pubescence. It is very similar to *spatulifer* and can be separated from that species only with difficulty. However, the trochanteral punctation helps in identification. Punctures are uniformly subcontiguous in *spatulifer*, but more than one diameter apart on the midtrochanteral venter anteriorly in most *crenulatus* (also on hindtrochanter in many specimens). Furthermore, the lip corners of *crenulatus* are closer to each other than to the orbits, and the frontal vestiture is silvery. In most *spatulifer*, the lip corners are closer to the orbits than to each other, and the frontal vestiture is golden (but see Variation under that species).

Description.—Frontal punctures fine, subcontiguous. Punctures no more than one diameter apart on vertex and scutum. Mesopleuron impunctate, microsculptured. Propodeal dorsum evenly microareolate; side and hindface coriaceous or microridged, but side finely ridged in some males. Hindcoxa not carinate or (some females) carinate only basally.

Setae appressed on scutum and femora, suberect on hypo-

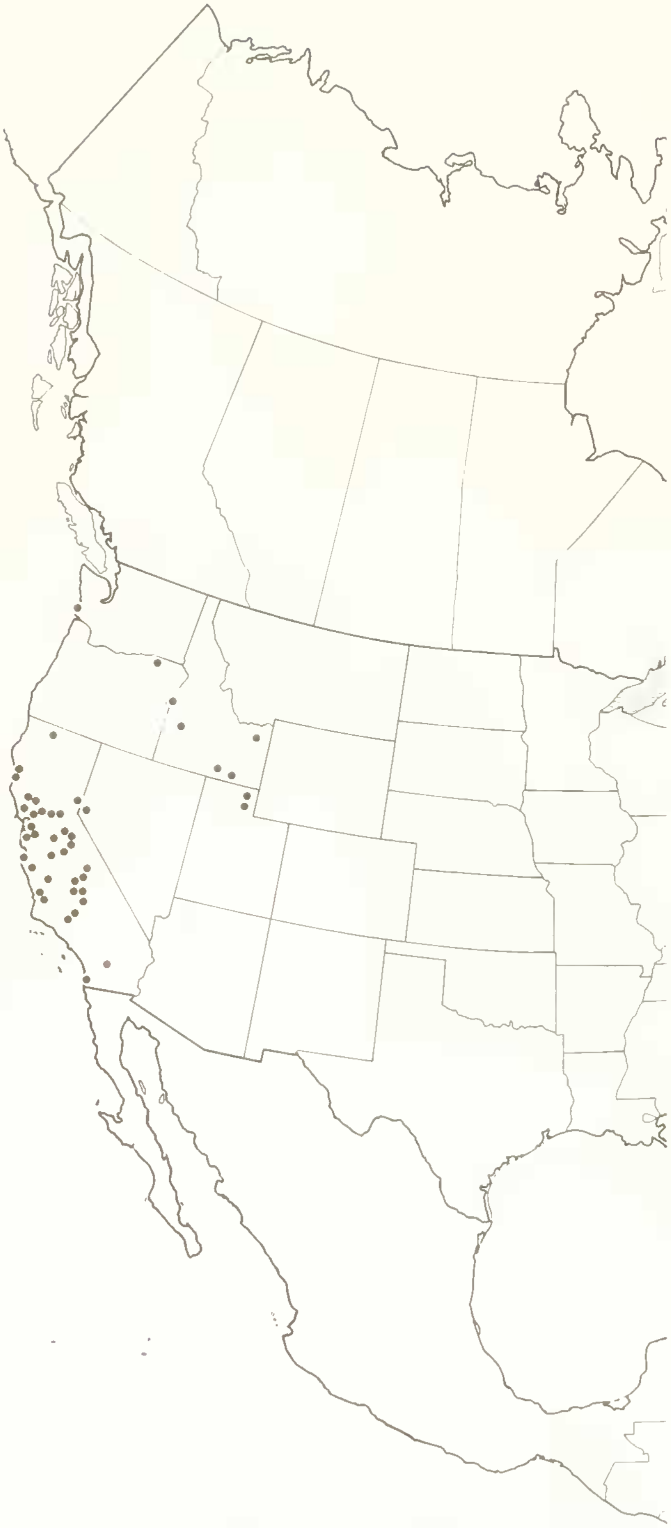

FIGURE 40. Geographic distribution of *Tachysphex spatulifer* Pulawski.

epimeral area, subappressed beneath mesopleural scrobe, oriented evenly posterad on scutum at middle.

Head, thorax, and legs black, or hindfemur (some females) and hindtibia (some males) partly red; tarsal apex reddish. Gaster all red, or (some females) with irregular, black spots, or (a male from Phoenix, Arizona) gastral apex black.

♀.—Clypeus (Fig. 41a, b): bevel longer than basomedian area; lip margin in most specimens with one lateral and one sublateral incision and with mesal notch that is flanked by an obtuse tooth on each side; free margin undulate in specimens in which incisions are absent; lip surface with several shallow, ill-defined concavities. Dorsal length of flagellomere I 2.2–2.6 × apical width. Vertex as wide as long or wider. Discal micropunctures of tergum II at least one to two diameters apart, of tergum III two to five diameters apart. Tergum V with a few, scattered punctures, its apical depression impunctate. Pygidial plate smooth or alutaceous, sparsely punctate. Mid- and hindtrochanteral venter sparsely punctate, shiny. Forefemoral venter with minute, subcontiguous punctures. Length 8–10 mm.

Integument not concealed by vestiture between antennal socket and orbit. Vertex setae appressed, suberect anteriorly, 0.3–0.5 MOD long.

Terga II–IV silvery fasciate apicolaterally (but fasciae evanescent in many specimens). Wings moderately infumate.

♂.—Mandibular inner margin not dentate (Fig. 41c). Clypeus (Fig. 41c): bevel indistinctly delimited from both lip and basomedian area, but shorter than the latter; lip roundly triangular to sharply prominent, side of prominence concave (lip corners pointed) or straight (most small specimens); in the latter case free margin not angulate between lobe and lateral clypeal section (lip corners inconspicuous); lip corners closer to each other than to orbits. Dorsal length of flagellomere I 1.2–1.7 × apical width. Vertex width 1.3–1.4 × length. Discal micropunctures of tergum II two to three diameters apart to (some specimens) one diameter apart. Sternal punctures fine, dense to (some specimens) sparse, apical depression of sterna II–VI occasionally impunctate. Forefemoral notch almost glabrous. Punctures of midtrochanteral venter anteriorly several to many diameters apart in most specimens, but one diameter or less apart in some individuals (extreme variants can be observed within a single population, e.g., in specimens from Yavapai Co., Arizona). Foretarsus without rake, but outer apical spine of foretarsomeres I and II in some specimens longer than width of these tarsomeres. Length 7–9 mm.

Vestiture partly hiding integument between antennal socket and orbit. Vertex setae erect, 0.8 MOD long, or appressed posteriorly and subappressed anteriorly, 0.6 MOD long.

Hindtibia largely red in two California specimens examined (UCD): from Short Canyon, Kern Co., and Tanbark Flat, Los Angeles Co. Terga II–IV (sometimes I–V) silvery fasciate apically, but fasciae interrupted mesally. Wings almost hyaline to weakly infumate.

LIFE HISTORY.—Two females examined (UCD) are pinned with prey acridids: one from Arroyo Seco, California with *Melanoplus marginatus* (Scudder), and one from Aztec, Arizona with *Trimerotropis* sp. (determinations by D. C. F. Rentz).

GEOGRAPHIC DISTRIBUTION (Fig. 42).—California, Nevada, to southern Colorado and southern New Mexico, also northern Baja California.

MATERIAL EXAMINED.—134♀, 214♂.

RECORDS.—UNITED STATES. ARIZONA. **Cochise:** Portal, 16 mi N Willcox. **Maricopa:** 8 mi S Buckeye, Gila Bend (also 12, 27, and 32 mi E), Phoenix, Rainbow valley, 15 mi SE Wickenburg, route 74 5 mi W route 17. **Mohave:** 5 mi N Kingman (also 15 mi W), Oatman, 17 mi SE Topock, Wikieup (also 24 mi SE). **Pima:** 10

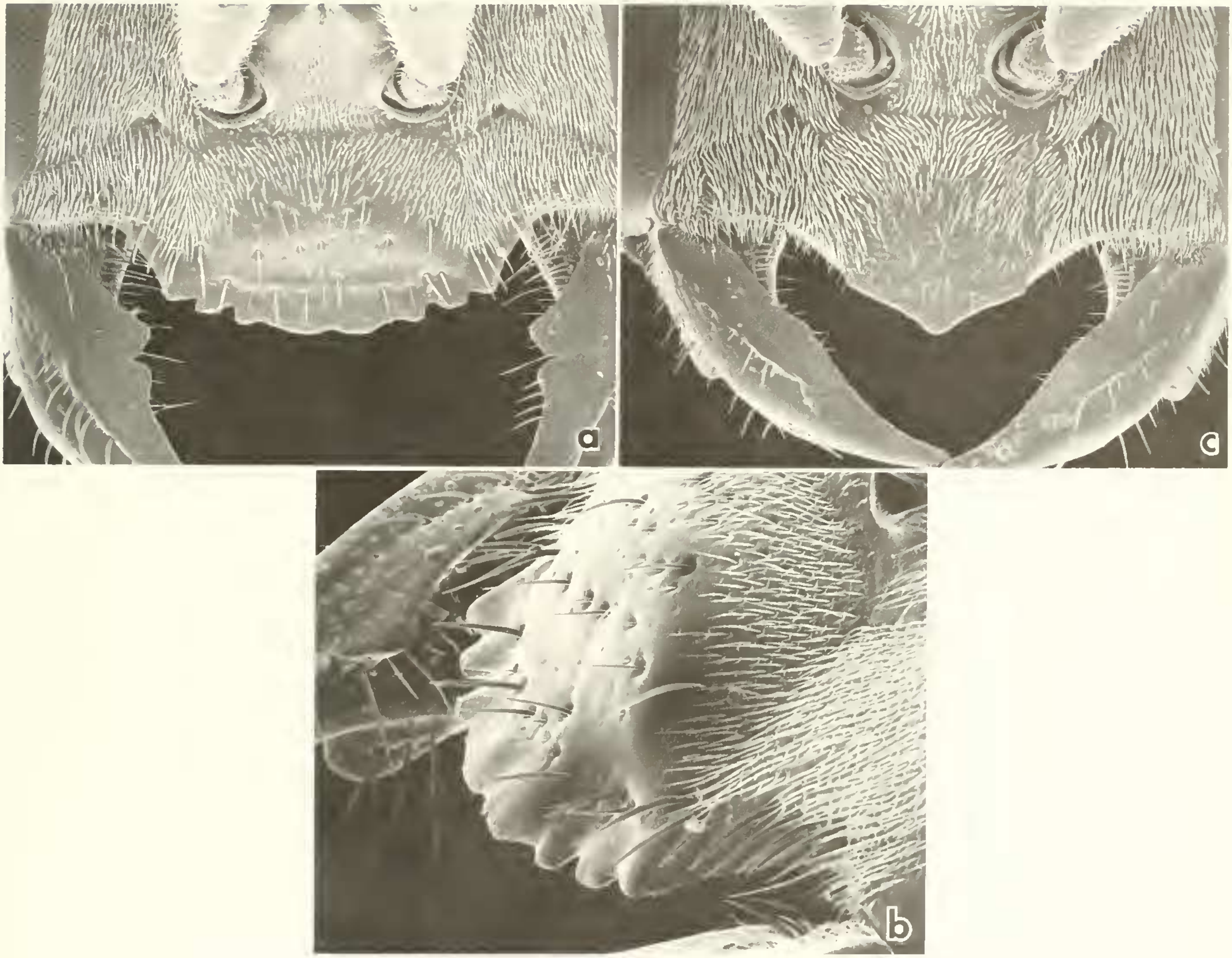

FIGURE 41. *Tachysphex crenulatus* W. Fox: a—female clypeus, b—clypeal lobe of female, oblique view; c—male of clypeus.

mi N Ajo, Sabino Canyon, Silver Bell, Tucson. **Pinal:** 9 mi N Florence, Picacho Pass. **Yavapai:** 8 mi N Aguila. **Yuma:** Aztec, 20 mi E Dateland, 7, 9, 14, and 32 mi S Quartzsite, 20 mi E Roll. CALIFORNIA: **Alameda:** Tesla Road. **Fresno:** Coalinga (also 10 mi W, 14 mi NE), Jacalitos Canyon (6 mi S Coalinga). **Kern:** 18 mi E Bakersfield, California City, Cuyama Valley, Glennville, Grapevine, McKittrick, Mill Potrero (18 mi SE Maricopa), 7 mi NW Mojave, Randsburg, Short Canyon. **Kings:** Avenal, Milham City. **Los Angeles:** 15 mi E Gorman, 5 mi S Lancaster, 8 mi N Llano, Palmdale, Tanbark Flat. **Madera:** Oakhurst. **Marin:** Alpine Lake. **Monterey:** Arroyo Seco, Monterey, 1 mi S Soledad, Stone Canyon (ca. 14 mi SW Coalinga). **Riverside:** Aguangua, Banning, Black Mountain, 18 mi W Blythe, Cabazon, Calimesa, Diamond Valley (3 mi S Hemet), Hemet Reservoir and Herkey Creek in San Jacinto Mts., Millard Canyon, Springs, Pinyon Flat (10 road mi SW Palm Desert), Riverside, Sage (also 5 mi S), Thousand Palms, Whitewater near Palm Springs. **San Benito:** Big Panoche Creek (San Benito and Fresno County line), 5 mi S Bitterwater, 4 and 14 mi E Paicines, Panoche. **San Bernardino:** Big Morongo Creek (4 mi W Essex), 1 mi E East Highlands, Granite Mts., Kramer Hills, Mid Hills (9 mi SSE Cima), Mojave Desert, Pioneertown, Summit Valley. **San Diego:** Banner, Borrego Valley (including Culp Valley), 1 mi S Del Mar, Descanso–Alpine, Jacumba, Julian, McCain Valley, Mountain Springs Pass Oasis, Pena Spring, San Diego, Warner Springs. **San Luis Obispo:** 2.5 and 10 mi S Creston, La Panza (12 mi NE Pozo), Pozo, 4 mi SE Santa Margarita, 10 mi W Simmler. **Santa Barbara:** Santa Ynez Mts. **Trinity:** Hayfork. **Tulare:** Lemoncove. COLORADO: **Montezuma:** Mesa Verde National Park. NEVADA: **Clark:** Riverside, Valley of Fire State Park. **Lyon:** 13 mi NE Dayton. NEW MEXICO: **Dona Ana:** 5 mi E Las Cruces, Organ Mts. **Hidalgo:** Granite Pass.

MEXICO: **Baja California Norte:** Arroyo Santo Domingo, Cataviña (also 39 and 53 mi S), 0.9–4 mi S El Condor, Ensenada, 6 mi E Ojos Negros.

Tachysphex miwok sp. n.

(Figures 43, 44)

DERIVATION OF NAME.—Named after the Miwok Indians of California; noun in apposition.

DIAGNOSIS.—*Tachysphex miwok* is known only from California and adjacent areas of Nevada. Its distinctive features are: mesopleuron impunctate or with evanescent punctures, setae appressed, inclined on the hypoepimeral area, oriented posterad on scutum at middle and anterolaterad on the propodeal dorsum. In the female, the clypeal lip is not emarginate mesally nor incised laterally (Fig. 43a), and the femora and tibiae are black. Females of *tahoe* and *tipai* are similar, but their setae are erect on vertex and along the hypostomal carina, possibly with exceptions in *tahoe* in which the clypeal lip is sinuate (in *miwok* the setae are appressed on vertex and along the hypostomal carina, and the clypeal lip is arcuate). The clypeal lobe is slightly more prominent than in *antennatus* (in which most females also

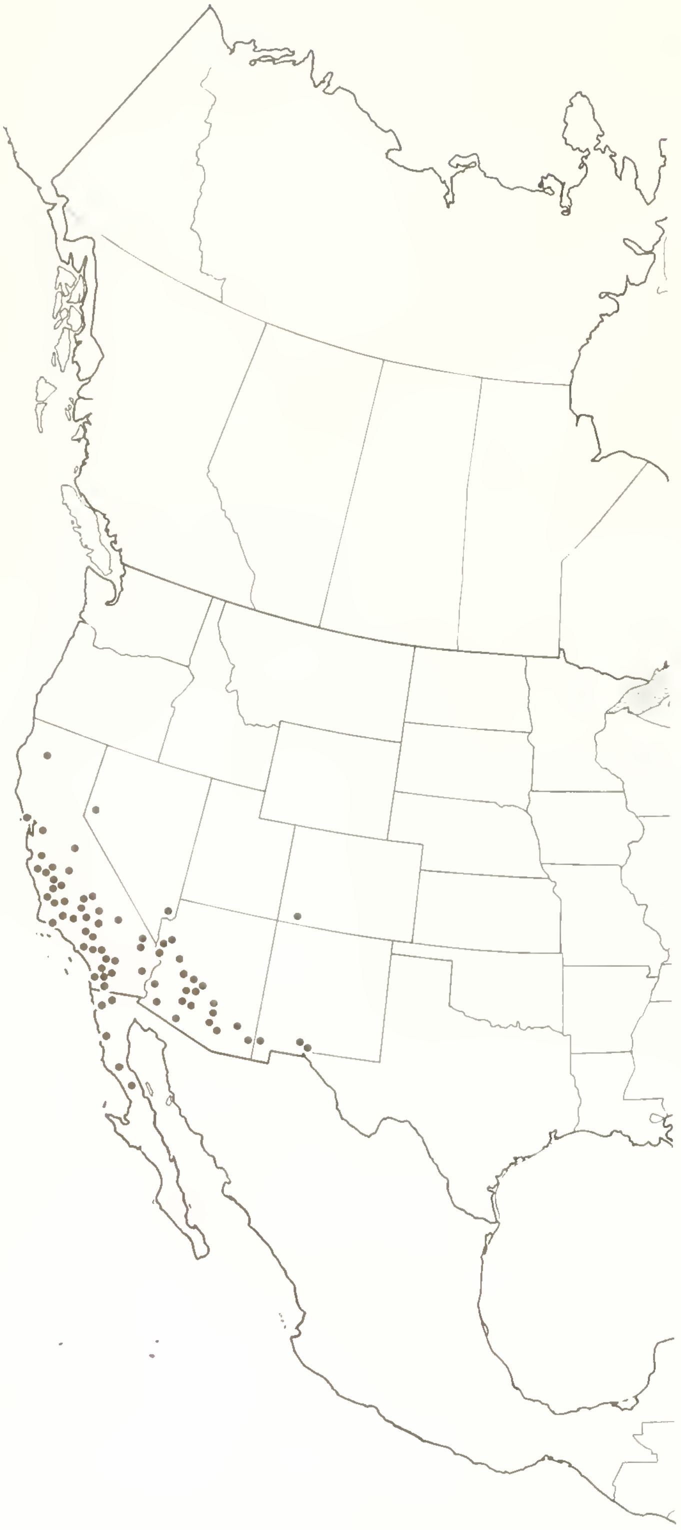

Figure 42. Geographic distribution of *Tachysphex crenulatus* W. Fox.

have a laterally incised lip). Some undescribed species are also similar, but they differ by at least one of the following characters (characters in parentheses refer to *miwok*): (1) mesopleuron shallowly punctate, (2) surface of clypeal lip with several shallow concavities (clypeal lip evenly flat), (3) in some species foretarsomeres I and II with no less than seven and five rake spines, respectively, and six and five, or seven and four, in some individuals (tarsomeres I and II with three to six and two to four spines, respectively; Fig. 43b), (4) four or more apical spines of foretarsomere I with confluent or contiguous apical fossae (none, two, or three apical spines of tarsomere I with confluent or contiguous basal fossae, two in most specimens).

The male of *miwok* has appressed vertex setae and a relatively broad clypeal lobe (Fig. 43c): distance between lip corners equals 1.2–1.4× clypeal length. *Tachysphex antennatus, krombeini,* and *crassiformis* are similar. In *miwok,* however, the axilla is the usual shape (expanded in *crassiformis*), the outer apical spine of foretarsomere II is as long as foretarsomere III or longer (shorter in *antennatus* and *crassiformis*), the propodeum is not marginate or barely marginate between dorsum and hindface (marginate in the other three), and the gaster is all or partly red (all black in *krombeini,* some *antennatus,* and some *crassiformis*). The well-defined clypeal bevel is an additional recognition feature of *miwok.*

In both sexes, the clypeal, frontal, and mesopleural pilosity is finer and less dense than in *antennatus, crassiformis,* and *krombeini,* but the difference is difficult to describe or to quantify.

Description.—Punctures subcontiguous on frons, vertex, scutum, and mesothoracic venter. Mesopleuron dull, microsculptured, its punctures ill defined, shallow, subcontiguous. Propodeal dorsum and side microareolate, or (some specimens) side with ill-defined ridges, or (some females) side with conspicuous ridges (Lobos Creek, Lone Pine area, Quatal Canyon); hindface microridged or ridged. Sternum I without apical depression. Hindcoxa not carinate.

Vestiture not obscuring integument between antennal socket and orbit (except from certain angles). Setae appressed on vertex, beneath mesopleural scrobe, and on midfemoral venter; suberect on hypoepimeral area; oriented posterad on scutum at middle and anterolaterad on propodeal dorsum (except oriented posterad basally).

Head and thorax black, gaster red or largely black (see Variation below). Legs black, tarsal apex reddish. Terga I–III or (some males) I–IV silvery fasciate apically (fasciae inconspicuous in many specimens). Wings hyaline. Frontal vestiture silvery.

♀.—Clypeus (Fig. 43a): bevel about as long as basomedian area; lip evenly arcuate, not emarginate mesally or incised laterally; free margin shallower between lip and orbit than in *antennatus* or *tarsatus.* Dorsal length of flagellomere I 1.8–2.0× apical width. Vertex width 1.0–1.5× length. Discal micropunctures of tergum II varying from one or two to several diameters apart. Tergum V with a few, sparse punctures, apical depression impunctate. Mid- and hindtrochanteral venter with minute, dense punctures, or partly impunctate. Length 5.0–7.5 mm.

♂.—Inner mandibular margin with tooth (Fig. 43c). Clypeus (Fig. 43c): bevel as long as basomedian area or shorter; lip truncate or arcuate, its corners obtuse, closer to orbits than to each other, separated by a distance that equals 1.2–1.4 of clypeal length. Dorsal length of flagellomere I 1.25–1.4× apical width. Vertex width 1.1–1.4× length. Sternal punctures minute, about as large as those on mesothoracic venter. Forefemoral notch glabrous. Forebasitarsus with none to two preapical rake spines;

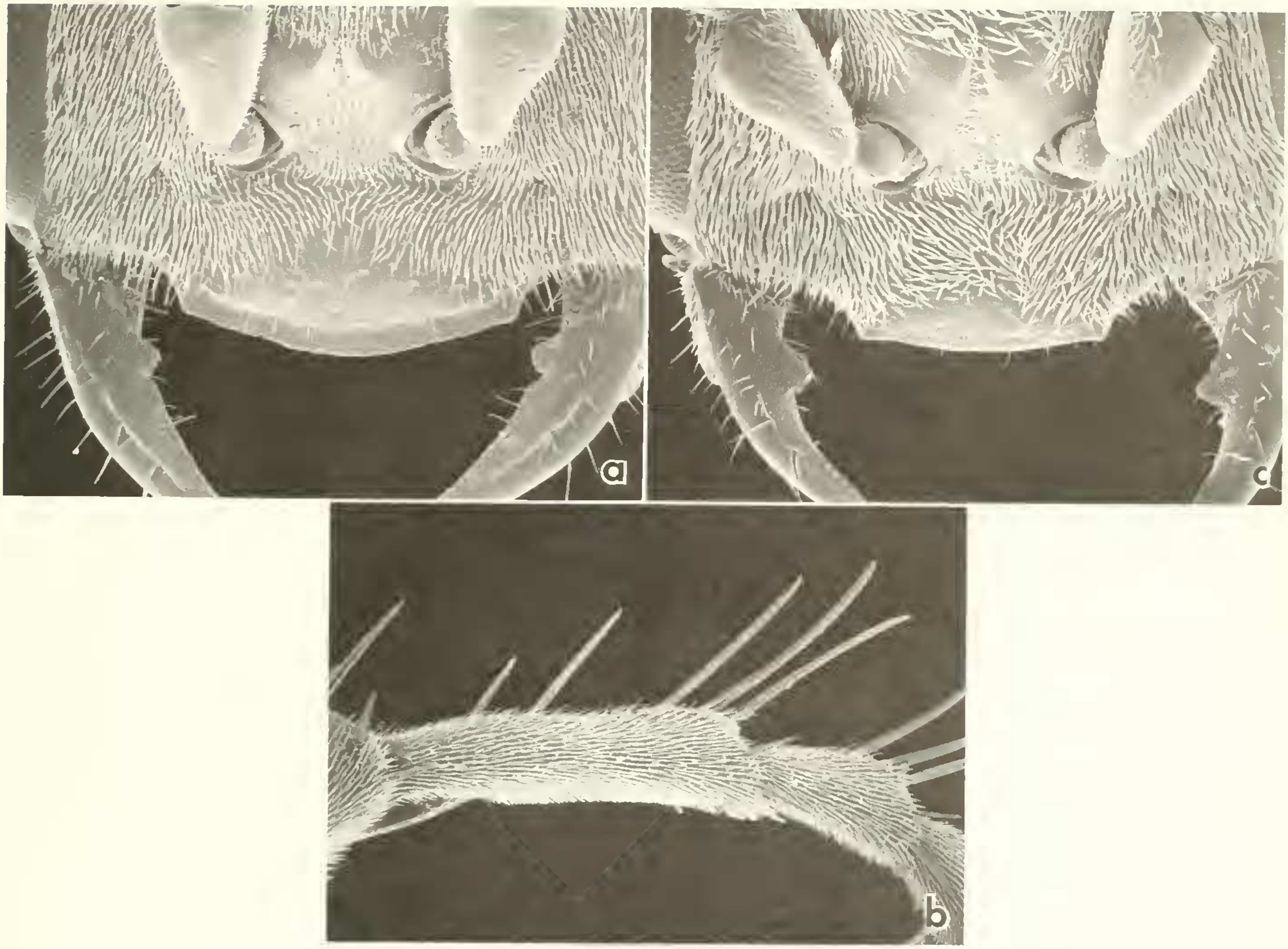

FIGURE 43. *Tachysphex miwok* sp. n.: a—female clypeus; b—basal articles of female foretarsus; c—male clypeus.

outer apical spine of foretarsomere II as long as foretarsomere III or longer. Length 5–6 mm.

Variation.—Vertex width : length ratio is about 1.2–1.5 (females) and 1.3–1.4 (males) in specimens from Monterey, San Francisco, and Marin counties, and also in the males from Canebrake Creek, California. This ratio is about 1.0 and 1.1, respectively, in remaining specimens studied.

Gaster red in most specimens, but in individuals from Monterey, San Francisco, and Marin counties, California, the gastral segment IV and the following ones are black (also segments I and III largely black in some specimens).

Life History.—A female from San Francisco (Laguna Puerca), California, is pinned with its prey: a 4.5-mm long nymph of an acridid, *Conozoa occidentalis* (Bruner), determined by D. C. F. Rentz.

Geographic Distribution (Fig. 44).—California: Coastal Ranges between San Francisco and Los Angeles areas, and central and southern Sierra Nevada; also adjacent areas of Nevada and montane areas of Baja California Norte.

Collecting Period.—3 March to 7 July.

Material Examined.—Holotype: ♂, California: San Francisco Co.: San Francisco: Presidio Park, 30 May 1982, WJP (CAS, Type #14155).

Paratypes (61♀, 56♂; specimens for which institution is not indicated are in CIS): UNITED STATES. CALIFORNIA. **Fresno:** Jacalitos Canyon, RMB (1♂, UCD), DSH (1♀, UCD). **Inyo:** 7 mi SW Lone Pine, P. A. Opler (1♂), Tuttle Creek, 2 mi SW Lone Pine, P. A. Opler (1♂). **Kern:** Canebrake Creek, 3 mi W Walker Pass, JAP (1♂), C. A. Toschi (1♂), Walker Pass, C. A. Toschi (2♀, 2♂), W. D. Veirs (1♀). **Los Angeles:** Llano, J. C. Hall (1♂, UCD); Pearblossom, R. R. Snelling (2♂, CAS, LACM); 2 mi S Pearblossom, R. R. Snelling and E. Williams (1♂, LACM). **Marin:** Point Reyes, D. D. Linsdale (1♀, UCD), C. D. MacNeill (1♂, CAS), JAP (1♀); Point Reyes National Seashore, W. J. Turner (1♀, 1♂, WSU). **Mono:** 5 mi NW Paradise Camp, ASM (1♂, UCD), FDP (2♀, CAS, 1♀, UCD). **Monterey:** Asilomar, D. J. Burdick (2♀, 3♂); Marina, MEI (3♂, UCR); Monterey, MSW (2♀, 2♂), Pacific Grove, MSW (2♀, 2♂, CAS; 2♀, 2♂, UCD), 1 mi S Soledad, JWMS (1♀). **Riverside:** Hemet Lake, MEI (1♂, UCR); Keen Campground, EIS (1♂, UCD); Whitewater Canyon, J. C. Hall (1♂, UCR). **San Benito:** Pinnacles National Monument, JWMS (1♀, UCD). **San Bernardino:** Apple Valley, N. McFarlane (1♂, LACM); 2 mi NE Baldwin Lake (San Bernardino Mts.), EIS (5♀); 4 mi S Barnwell, New York Mts., JAP (1♀), 9 mi SE Hesperia, E. Fisher (2♀, CAS, CSDA), Sheep Creek Canyon, A. L. Melander (1♀, UCD); 5 mi S Victorville, PDH (2♀). **San Diego:** 5 mi SE Warner Springs, P. M. Estes (1♂, UCR). **San Francisco:** Fort Funston, G. I. Stage and R. R. Snelling (1♂); Laguna Puerca, HKC (1♂), JAP (3♀, 7♂), J. R. Powers (1♂), R. R. Snelling (1♀, UCD). Lobos Creek, PHA (1♂, CAS), HKC (2♀, 3♂), J. F. Lawrence (1♂), JAP (1♀, 4♂), D. C. F. Rentz, V. F. Lee, M. S. Carter, C. L. Mullinex (1♀, 2♂, CAS), Lone Mountain, FXW (1♂, UCD); Marine Hospital, JAP (1♀); San Francisco, E. P. Van Duzee (1♀, 1♂, UCD), FXW (1♂, CAS), San Francisco, sand dunes, C. L. Fox (2♀, 1♂, UCD). **San Luis Obispo:** Dune Lake, 3 mi S Oceano, J. Doyen and JAP (1♀); Oso Flaco Lake, 5 mi S Oceano, JAP (4♂). **Ventura:** Hungry Valley (5 mi S Gorman), G. I. Stage (1♀), Lockwood Canyon near Stauffer P. O., G. I.

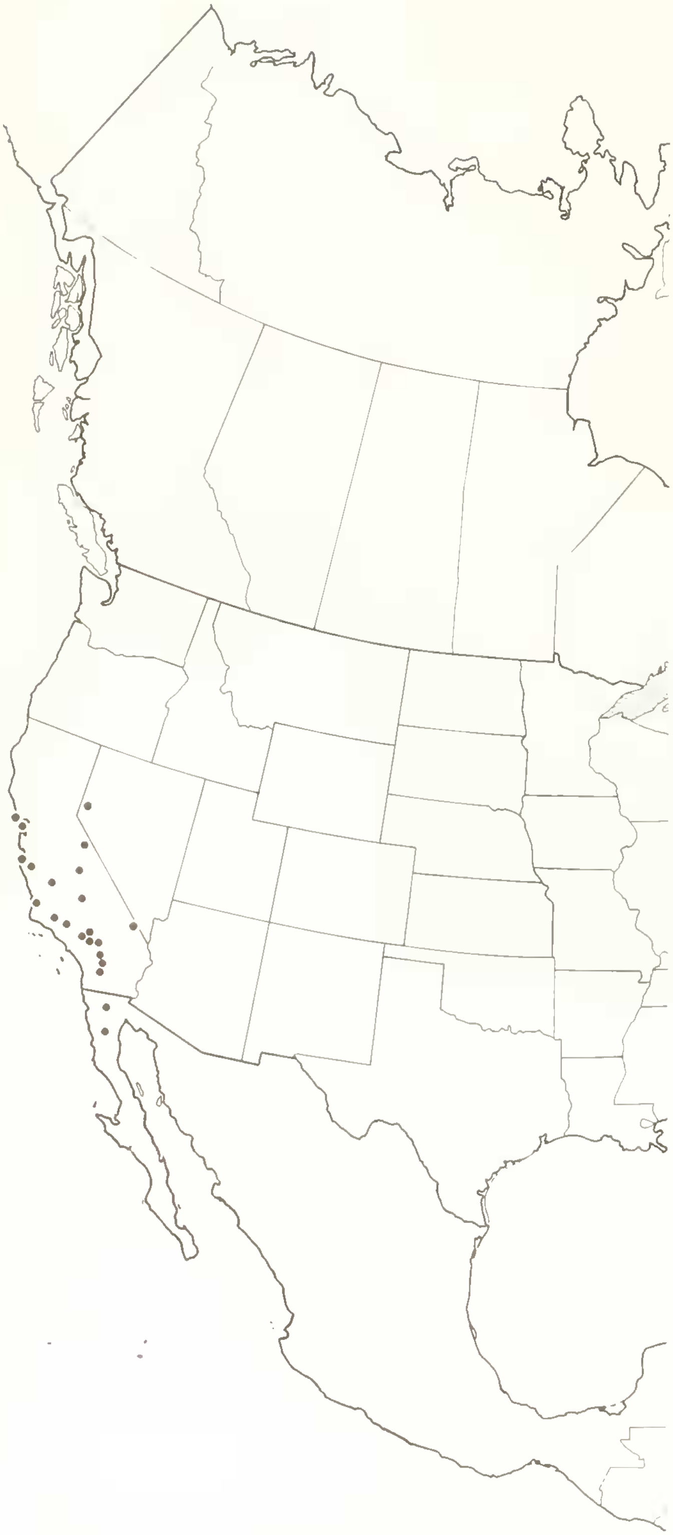

FIGURE 44. Geographic distribution of *Tachysphex miwok* sp. n.

Stage (1♂, 1♀). Lockwood Creek near Stauffer Post Office, JAP (3♀), G. I. Stage (1♀). Quatal Canyon (NW part of county), JAP (1♂), J. R. Powers (1♂). NEVADA Washoe: 1 mi S Mustang, FDP (1♂, UCD).

MEXICO. **Baja California Norte:** Las Encinas (Sierra San Pedro Martir), JWB and DKF (1♂, SDNH). 6 mi N Laguna Hanson (Sierra de Juárez), collector not indicated (1♂, SDNH).

Tachysphex krombeini Kurczewski

(Figures 45, 47)

Tachysphex sp. No. 3: Krombein and Evans 1954:233, 1955:231.

Tachysphex krombeini Kurczewski, 1971:111, ♂, ♀. Holotype: ♂, Florida: Desoto Co.: Arcadia (USNM).—Bohart and Menke 1976:274. Krombein 1979:1628.

DIAGNOSIS.—*Tachysphex krombeini* is an all black species with ill-defined mesopleural punctures which occurs in the southeastern United States (North Carolina to Florida and Alabama). Like most *antennatus* and most *crassiformis*, the propodeal dorsum of *krombeini* is relatively flat, not sloping posteriorly toward the transverse carina that separates it from the hindface. It differs from these two species in having a slightly more prominent clypeal lobe (compare Fig. 45a and 46a); in the female the pygidial plate is markedly alutaceous (Fig. 45b), at least basally (not or weakly alutaceous in the other two); in the male, the forebasitarsus has three or four preapical rake spines (no preapical spines in the other two or two to four such spines present in occasional *antennatus* from California). Unlike most *crassiformis*, the axilla is simple in *krombeini*.

Tachysphex krombeini also resembles *tarsatus* and *williamsi* in having mesopleural setae appressed or weakly inclined, but their clypeus is slightly different (compare Fig. 45a and 34a). Unlike *krombeini*, the propodeal dorsum of these species slopes posterad toward the transverse carina that separates it from the hindface (though slightly so in some specimens), and the males have distinctive sternal setae. Furthermore, *williamsi* is a western species, and southeastern populations of *tarsatus* have a red gaster.

DESCRIPTION.—Frons dull, its punctures shallow, ill defined, subcontiguous. Vertex and scutum punctate, punctures less than one diameter apart. Mesopleuron dull, its punctures fine, ill defined, subcontiguous. Propodeal dorsum evenly microareolate; side dull, microridged, or (mostly in males) evenly microareolate; hindface ridged, margined above by sharp, mesally interrupted carina. Sternum I with apical depression. Discal micropunctures of tergum II two to three diameters apart. Hindcoxa carinate.

Vestiture almost completely obscuring integument between antennal socket and orbit, partly hiding mesopleural sculpture. Setae appressed on vertex, scutum, and femora, appressed or weakly inclined on mesopleuron.

Body black, tarsal apex dark brown; apical depression of terga II and III testaceous in many specimens. Terga I–IV silvery fasciate apically. Frontal vestiture silvery. Wings faintly infumate.

♀.—Clypeus (Fig. 45a): bevel shorter than basomedian area; lip arcuate, not incised laterally to almost straight, laterally incised. Dorsal length of flagellomere I 1.7–1.9× apical width. Vertex width 1.1–1.2× length. Tergum V densely punctate, except apical depression largely impunctate. Pygidial plate sparsely punctate, in most specimens coarsely microsculptured (Fig. 45b), at least basally. Trochanters and femora evenly micropunctured. Length 5.0–6.5 mm.

♂.—Mandibular inner margin with tooth (Fig. 45c). Clypeus (Fig. 45c): bevel shorter than basomedian area; lip evenly arcuate, its corners obtuse, closer to orbit than to each other,

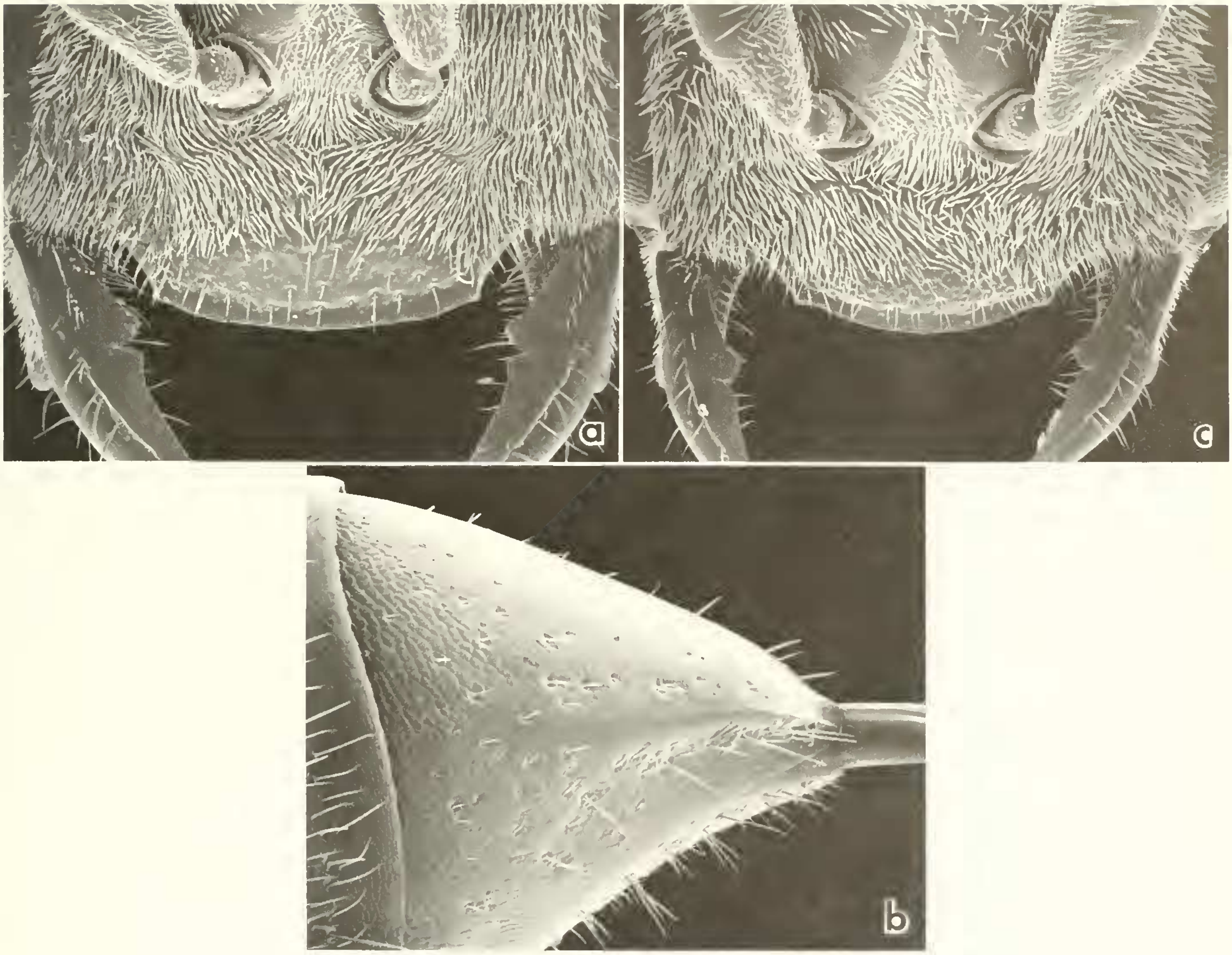

FIGURE 45. *Tachysphex krombeini* Kurczewski: a—female clypeus; b—pygidial plate of female; c—male clypeus.

separated by a distance that equals 1.3–1.5 of clypeal length. Dorsal length of flagellomere I 1.1–1.4 × apical width. Vertex width 1.8–2.0 × length. Sterna punctate throughout. Forefemoral notch glabrous. Forebasitarsus with three or (some individuals) four preapical rake spines that are slightly shorter to slightly longer than basitarsal width; outer apical spine of foretarsomere II slightly shorter than tarsomere III. Length 4–5 mm.

LIFE HISTORY.—*Tachysphex krombeini* has been studied by Kurczewski (1971). The species nests in sparsely vegetated sandy areas and appears from the end of March to at least the end of June; consequently, there must be at least two generations per year. A nest observed at Arcadia, Florida, was permanently open during the provisioning period. The burrow, 3 mm in diameter, entered the sand at an angle of about 37° to the horizon and terminated in a small, oval cell 2.8 cm beneath the surface. The sand removed from the burrow formed a tumulus. Prey were brought to the nest in flight. The wasp held the prey under her body with her legs, grasping its antennae with her mandibles. She plunged into the entrance, quickly releasing the prey just inside. She reappeared headfirst and, grasping the prey by its antennae with her mandibles, backed into the nest. Each prey was deposited venter up, and this fact suggests that they were carried to the nest in this position. The cell contained six nymphs of *Melanoplus* sp. (Acrididae) and one nymph of *Odontoxiphidium apterum* Morse (Tettigoniidae). All were arranged head inward; five acridids (including the egg-bearer) venter up, two remaining dorsum up. The wasp's egg was attached by the cephalic end to the soft corium surrounding the base of the largest acridid's left forecoxa and laid transversely behind the forelegs. After completing provisioning, the female raked sand backward with the forelegs bent mesad, then she backed into the burrow while raking and packed the sand into the tunnel with the bent end of her gaster. While hammering with her pygidium, she held her antennal tips against the wall of the burrow.

GEOGRAPHIC DISTRIBUTION (Fig. 47).—North Carolina to Alabama and Florida.

MATERIAL EXAMINED.—25♀, 12♂, including 9♀, 8♂ paratypes (CAS, CU, FSCA, KVK, MCZ, NYSU, UGA, USNM, WJP).

Records.—UNITED STATES. ALABAMA. **Baldwin:** Gulf Shores. FLORIDA. **Alachua:** Gainesville, Monteoca (11 mi NW Gainesville). **Desoto:** Arcadia. **Gadsden:** Quincy. **Glades:** Palmdale. **Hernando:** 4 mi NE Lacoochee. **Highlands:** Lake Placid (Archbold Biological Station). **Lee:** Olga. **Liberty:** Torreya State Park. **Okaloosa:** 1.7 mi N Holt. **Orange:** Orlando. GEORGIA. **Lanier:** Lakeland. NORTH CAROLINA. **Cumberland:** Fort Bragg.

Tachysphex antennatus W. Fox

(Figures 46, 47)

Tachysphex antennatus W. Fox, 1894*a*:516, ♀, ♂. Holotype: ♀, Texas: no specific locality (ANSP).—Dalla Torre 1897:678. Ashmead 1899:250; Rohwer 1911:580 (in key). Cresson 1928:43, G. Bohart 1951:950, Bohart and Menke 1976:272, Krombein 1979:1628, Elliott and Kurczewski 1985:293.

Tachysphex sculptuloides Williams, 1914:166, ♀, ♂. Holotype: ♀, Kansas: Barton Co.: no specific locality (KU). Synonymized by Pulawski *in* Krombein 1979:1628.—G. Bohart 1951:952, LaBerge 1956:528, Arnaud 1970:33, Bohart and Menke 1976:276.

Tachysphex nigrocaudatus Williams, 1914:167, ♀, ♂. Holotype: ♀, Kansas: Rush Co.: no specific locality (KU). Synonymized by Pulawski *in* Krombein 1979:1628.—Mickel 1918:424. Brimley 1938:443, G. Bohart 1951:951, LaBerge 1956:527, Arnaud 1970:32, Bohart and Menke 1976:275.

Diagnosis.—*Tachysphex antennatus* has an unusually broad clypeal lobe (Fig. 46a, d): the distance between its corners equals 1.8–2.5 × the clypeal length in the female and 1.5–1.6 × in most males. Clypeal proportions are identical or similar in several other species, but in *antennatus* the vertex setae are appressed (erect in *pinal* and *toltec*) and the axilla slopes gradually (axilla steplike or expanded in *crassiformis* and *paiute*, see these species for further differences). In most females, the clypeal lip is incised laterally and the legs are black (lip not incised and hindfemur and hindtibia all or partly red in *occidentalis*), but in some specimens the lip is entire, and in some others the hindlegs are all or largely red (these two conditions are rare and presumably do not occur together in the same specimen). *Tachysphex antennatus* is also similar to *cubanus*, *miwok*, and *krombeini* and can be separated by the characters given under these species (pages 77, 67 and 70).

The clypeal lobe is narrow in some males of *antennatus* (distance between lobe corners about 1.2 × clypeal length). Such individuals can be recognized by a nearly straight clypeal lip combined with appressed mesopleural vestiture.

Description.—Punctures less than one diameter apart on frons, vertex, and scutum (more than that in some females) and on mesothoracic venter. Mesopleuron microsculptured, with minute punctures (Fig. 46b) that are inconspicuous in many specimens. Propodeal dorsum evenly microareolate, rugose in some specimens, not sloping or barely sloping toward transverse carina that separates it from hindface; carina well defined except absent laterally in smallest specimens; side and hindface ridged (Fig. 46c), but ridges largely evanescent in some specimens. Apical depression of sternum I absent or ill defined. Discal micropunctures of tergum II about two to three diameters apart. Hindcoxa carinate except in smallest males.

Integument visible between antennal socket and orbit from certain angles in female, from many angles in male. Setae appressed, shorter than 1.0 MOD on vertex; oriented evenly posterad to transversely on midscutum; appressed to inclined on mesopleuron; basal setae of propodeal dorsum oriented posterad and laterad; nearly appressed on scutum and midfemoral venter.

Head, thorax, and legs black, tarsal apex brown, hindtibia red in some females from Animas area, New Mexico. Wings weakly infumate. Frontal vestiture silvery or with golden tinge.

♀.—Clypeus (Fig. 46a): lobe broad (distance between lip corners 1.8–2.5 × clypeal length); bevel longer than basomedian area, equal in some specimens; lip weakly arcuate or weakly sinuate, not emarginate mesally, incised laterally or (some specimens) entire. Dorsal length of flagellomere I 1.6–1.9 × apical width. Vertex width 1.2–1.4 × length. Tergum V sparsely punctate mesally, its apical depression impunctate. Pygidial plate shiny, sparsely punctate. Trochanters and forefemoral venter finely, closely punctate. Length 5.5–8.0 mm.

Gaster red to black, terga I–III or I–IV silvery fasciate apically.

♂.—Mandibular inner margin with tooth (Fig. 46d). Clypeus (Fig. 46d): lobe almost flat, of varying width (see Individual Variation below), with weakly sinuate free margin; its corners obtuse but well defined; bevel shorter than basomedian area. Dorsal length of flagellomere I 1.0–1.4 × apical width. Vertex width 1.3–2.1 × length. Sterna evenly, densely punctate throughout, punctures finer than those on mesothoracic venter. Forefemoral notch finely pruinose. Forebasitarsus with none to four preapical rake spines that are no longer than basitarsal width (see Individual Variation below). Length 4.5–6.0 mm.

Gaster black or segments I–III red, terga I–IV or I–V silvery fasciate apically.

Individual Variation.—In most females, terga I and II or I–III are red, and the remainder is black. The gaster is all red in many western specimens, but it is all black in many females from Texas, California, Nevada, a female from Teotihuacán, Mexico, and a female from Osoyoos, British Columbia.

In most males, the foretarsal rake is absent (only the apical spine is present), and the outer apical spine of foretarsomere II is shorter than tarsomere III. However, some black specimens from Carnelian Bay, California, have two apical spines on foretarsomeres I and II. In a few specimens from the same locality, there are three or four rake spines on the forebasitarsus, and the outer apical spine of foretarsomere II is as long as tarsomere III. The gaster is black in most males, but segments I–III are red in many individuals from California.

In most males, the clypeal lip is weakly arcuate, and its corners are closer to the orbit than to each other; they are separated by a distance equal to 1.5–1.6 of the clypeal length. The clypeus is exceptionally narrow in three males from Sycamore Canyon, Arizona: the lip is straight or weakly emarginate, and its corners are closer to each other than to the orbits (as 0.8:1); they are separated by a distance equal to 1.2–1.3 of the clypeal length.

Geographic Variation.—Eastern and western populations of *antennatus* differ in thoracic sculpture and pilosity, as discussed below. The differences, some of them easy to observe but difficult to describe or to quantify, are probably correlated with the humidity of the respective habitats. In the eastern specimens, mesopleural micropunctures are smaller, less conspicuous; mesopleural setae are somewhat less dense and more inclined; ridges of the propodeal side are slightly finer and denser; and setae of the propodeal dorsum are oriented anterad along the midline; in the female, scutal punctures are close to each other, almost contiguous. This form is distributed from the East Coast throughout Mexico, southeastern Arizona, and Colorado. In the western specimens, mesopleural micropunctures are larger, more conspicuous; mesopleural setae are slightly denser and less inclined; ridges of the propodeal side are slightly larger and less dense; and setae of the propodeal dorsum are oriented anterolaterad, parted along midline; in the female, scutal punctures

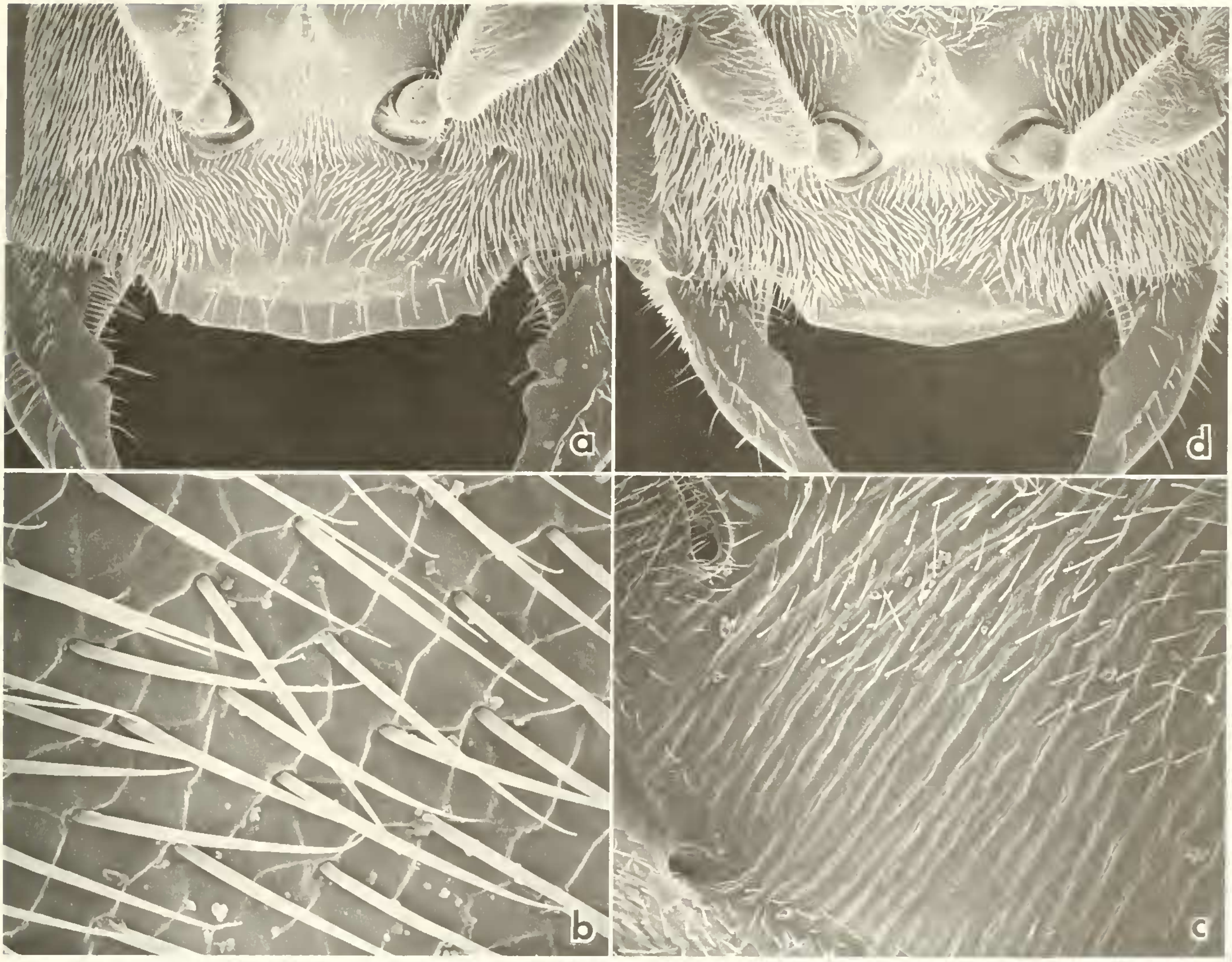

FIGURE 46. *Tachysphex antennatus* W. Fox: a—female clypeus; b—sculpture of female mesopleuron; c—sculpture of propodeal side of female; d—male clypeus.

are two to four diameters apart on each side of the median zone. The western form occurs between the West Coast and the Rocky Mountains.

LIFE HISTORY.—Specimens from Animas area, New Mexico, were collected on flowers of *Baccharis glutinosa* Pers. Elliott and Kurczewski (1985:293) noted two females carrying nymphal acridids, *Melanoplus* sp. in short, low flights at Erie, Pennsylvania.

GEOGRAPHIC DISTRIBUTION (Fig. 47).—Southwestern Canada, United States, Mexico.

MATERIAL EXAMINED.—832♀, 684♂.

RECORDS.—CANADA: **British Columbia:** Osoyoos (Richter Pass).

UNITED STATES: ARIZONA. **Cochise. Gila:** San Carlos. **Graham:** Roper Lake State Park. **Maricopa:** road 74.5 mi W road 17. **Mohave:** Bullhead City, Mohave Valley. **Pima:** Madera Canyon, Sabino Canyon, Tucson (also 10 mi NE). **Santa Cruz.** CALIFORNIA: **Alameda:** Sycamore Grove State Park. **Alpine:** Hope Valley, Winnemucca Lake. **Butte:** 20 mi N Yuba City. **Colusa:** 21 mi SW Williams. **Contra Costa:** Antioch, Moraga, Mt. Diablo. **El Dorado. Fresno:** Coalinga (also 8 mi NW). **Glenn:** Plaskett Meadows. **Inyo. Kern. Lake:** Borax Lake, N Fork Cache Creek at Highway 20. **Lassen:** Hallelujah Junction, Norvell, Summit Camp (E Lassen Peak). **Los Angeles. Marin:** Point Reyes. **Modoc. Mono. Monterey:** Arroyo Seco, Monterey, Soledad. **Napa:** Samuel Spring (now bottom of Lake Berryessa). **Nevada. Orange:** Laguna Canyon, Peters Canyon, Potrero Canyon. **Placer. Plumas:** Buck's Lake, 6 mi E Chester, Quincy. **Riverside. Sacramento:** Sacramento. **San Benito:** Pinnacles National Monument. **San Bernardino. San Diego. San Francisco:** San Francisco (Laguna Puerca, Lobos Creek, Marine Hospital, Presidio Park). **San Joaquin:** Stockton. **San Luis Obispo. San Mateo:** San Bruno. **Santa Barbara:** 4 mi E Los Prietos. **Santa Cruz:** Felton, Laurel. **Shasta:** Hat Creek Post Office, Hat Lake (NE Lassen Peak), Moose Camp. **Sierra. Siskiyou. Trinity:** Hayfork. **Tulare:** Fairview, Lemoncove. **Tuolumne. Ventura:** 5 mi S Gorman, Lockweed Creek near Stauffer Post Office, 1 mi W Santa Susana. **Yolo. Yuba:** 18 mi S Marysville. COLORADO: **Bent:** Hasty. **Boulder:** Boulder. **Denver:** Denver. **Fremont:** Canon City. **Gunnison:** Lead King Basin. **Jefferson:** Clear Creek, Morrison. **Larimer:** Fort Collins (Flatiron Site, e). DISTRICT OF COLUMBIA. Washington. FLORIDA: **Alachua:** Gainesville. GEORGIA: **Clarke:** Athens, Whitehall Forest. IDAHO: **Bear Lake:** Paris. **Cassia:** 7 and 8 mi SW Malta. **Fremont:** Saint Anthony Sand Dunes. **Lincoln:** Dietrich Butte, Owynza, 7 mi W Shoshone. ILLINOIS. **Champaign:** Trealese Woods. **Williamson:** Crab Orchard Lake. IOWA. **Woodbury:** Sioux City. KANSAS: **Barton:** —. **Douglas:** Baldwin. **Ellis, Ness:** —. **Gray:** Cimarron. **Pottawatomie:** Onaga. **Riley:** Manhattan. **Rush:** —. **Stafford:** Salt Marsh. LOUISIANA: **St. Landry:** Opelousas. MARYLAND. **Montgomery:** Colesville, Penny Field Locks. MICHIGAN: **Cheboygan, Livingstone:** —. **Washtenaw:** Ann Arbor (Matthaei Botanical Garden), Half Moon Bay Pinckney Recreation Area. MISSOURI: **Boone:** Columbia. **Jackson:** Atherton. **Vernon:** Nevada. MONTANA: **Rosebud:** Ashland. NEBRASKA: **Adams:** Hastings. **Dawes:** Chadron. **Hall:** 6 mi W Cairo. NEVADA: **Churchill:** Carson Sink. **Douglas:** Minden, Spooners Lake (N Junction Highway 28). **Elko:** 7 mi NE Carlin. **Mineral:** 4.5 mi S Schurz. **Nye:**

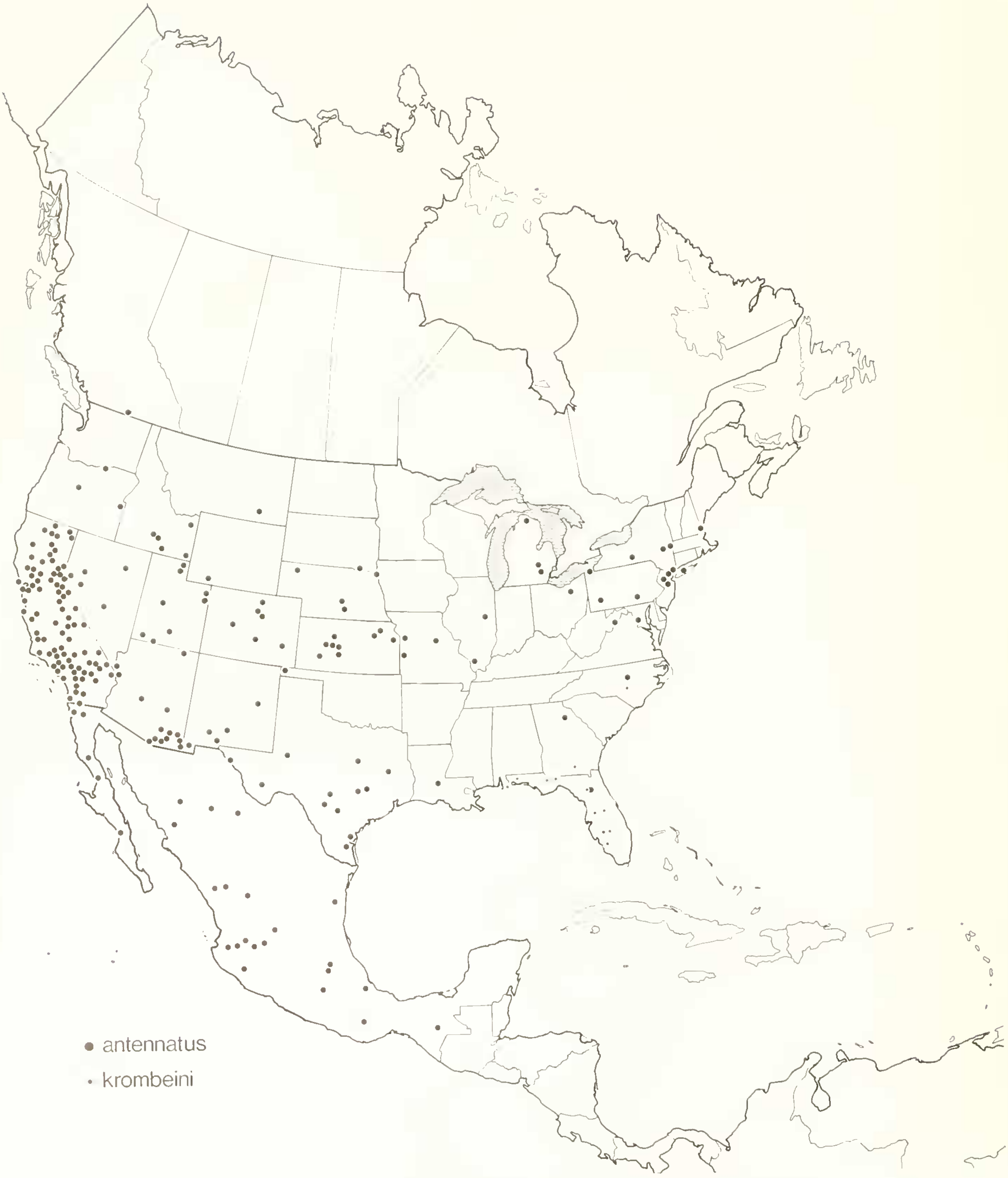

FIGURE 47. Geographic distribution of *Tachysphex antennatus* W. Fox and *krombeini* Kurczewski

4 mi S Warm Springs. **Washoe.** NEW HAMPSHIRE: **Rockingham:** Hampton. NEW JERSEY **Bergen:** Mahwah. **Mercer:** Princeton. **Morris:** Long Valley. NEW MEXICO: **Colfax:** Raton. **De Baca:** Sumner Lake State Park. **Dona Ana:** 5 mi E Las Cruces, Leesburg Dam State Park. **Hidalgo:** 15 mi S Animas. **Otero:** Alamogordo. **Sierra:** Percha Dam State Park. NEW YORK: **Albany:** Rensselaerville. **Rensselaer:** Brainard. **Suffolk:** Huntington. **Tompkins:** Ithaca. **Westchester:** Lewisboro. NORTH CAROLINA. **Wake:** Raleigh. OHIO: **Summit:** Barberton. OKLAHOMA. **Cimarron:** Black Mesa State Park. OREGON: **Crook:** Powell Butte. **Deschutes:** Smith Rock State Park. **Malheur:** 3 mi S Vale. **Morrow:** Boardman. PENNSYLVANIA: **Erie:** Erie. **York:** 5 mi NW Davidsburg. **Westmoreland:** Jeanette. SOUTH DAKOTA: **Bon Homme:** Springfield. TEXAS: **Anderson:** Salmon. **Bastrop:** 6 mi E Bastrop. **Bexar:** Fort Sam Houston. **Brazos:** College Station. **Brewster:** 9 mi S Alpine. **Hudspeth:** McNary. **Jeff Davis:** near Point of Rocks (10 mi W Fort Davis). **Kimble:** Junction. **Kleberg:** Kingsville (also 20 mi SE). **Lee:** Fedor. **Midland:** Midland. **San Patrizio:** Aransas River 10 mi NE Sinton. **Somervell:** Dinosaur Valley State Park. **Uvalde:** 30 mi N Uvalde. UTAH: **Cache. Garfield:** Boulder. **Kane:** Kanab. **Millard:** Delta. **Uintah:** SW Bonanza, Green River (5 mi NE Jensen), road 44. **Washington:** 1 mi W Leeds. **Weber:** Willard Peak. VIRGINIA: **Arlington:** Arlington. **Fairfax:** Alexandria, Clifton, Dunn Loring near Vienna. WEST VIRGINIA **Hardy:** Lost River State Park. WYOMING: **Sweetwater:** Green River.

MEXICO: **Baja California Norte:** Cataviña (also 39 and 53 mi S), 4 mi S El Cóndor, Ensenada, Laguna Hanson (41 mi S La Rumorosa), Progreso (Sierra Juárez), 1 mi E Santa Inés, 8 mi E Tecate, 12.3 mi S Valle de las Palmas. **Baja California Sur:** La Purisima (6.8 mi S San Juanico), 16 mi S Rosarito. **Chiapas:** San Cristóbal de las Casas (also 21 mi E). **Chihuahua:** 15 mi E Cuauhtémoc, Santa Clara Canyon 5 mi W Parrita. **Durango:** 7, 10, and 25 mi W Durango. **Jalisco:** El Tigre, Estanzuela (40 km W Ameca), Guadalajara (also 15 and 16 mi NE), Ixtlahucán del Rio, 6 mi S Ojuelos, 8 mi NW Tequila, Villa Guadalupe. **Mexico:** Teotihuacán Pyramids. **Morelos:** 4 mi E Cuernavaca. **Oaxaca:** Oaxaca. **Sonora:** Alamos, 15–25 km NW Yecora. **Tamaulipas:** 80 km S Ciudad Victoria, 15 mi N Llera. **Veracruz:** Fortin de las Flores. **Zacatecas:** 15 km E Sombrerete.

Tachysphex crassiformis Viereck

(Figures 48, 49)

Tachysphex crassiformis Viereck, 1906:210, ♀. ! Holotype: ♀, Kansas: Hamilton Co.: no specific locality (KU).—Williams 1914:168; G. Bohart 1951:950; LaBerge 1956:527; Bohart and Menke 1976:273; Krombein 1979:1627.

Tachysphex wheeleri Rohwer, 1911:579, ♀. ! Holotype: ♀, Texas: Lee Co.: no specific locality (USNM). Synonymized by Pulawski *in* Krombein 1979:1628.—G. Bohart 1951:953; Krombein 1967:394. Bohart and Menke 1976:277.

Tachysphex plenoculiformis Williams, 1914:167, ♀. ! Holotype: ♀, Kansas: Ness Co.: no specific locality (KU). Synonymized by Pulawski *in* Krombein 1979:1628.—Williams 1914:201; G. Bohart 1951:952, LaBerge 1956:527, Arnaud 1970:32, Bohart and Menke 1976:275.

Tachysphex n. sp.: Krombein 1949:267, 1953*a*:330, 1953*b*:132.

Tachysphex sp. No. 4: Krombein and Evans 1955:231.

Tachysphex boharti Krombein, 1963*a*:177, ♀, ♂. ! Holotype: ♀, North Carolina: Dare Co.: Kill Devil Hills (USNM). Synonymized by Pulawski *in* Krombein 1979:1628.—Krombein 1967:392; Wray 1967:123. Kurczewski 1971:114 (in key); Bohart and Menke 1976:272.

Tachysphex gibbus Pulawski, 1974*a*:20, ♀, ♂. ! Holotype: ♀, El Salvador: Quezaltepeque (UCD). Synonymized by Pulawski *in* Krombein 1979:1628.—Bohart and Menke 1976:274

DIAGNOSIS.—Most *crassiformis* have a prominent scutal hindcorner and an expanded or steplike axilla (Fig. 48b, d, e), two characters shared only with *paiute*. The midscutal gibbosity (Fig. 48c) present in some individuals is not found in any other *Tachysphex*. Unlike *paiute*, the hypostomal carina of *crassiformis* is low (the usual size), the adjacent setae are shorter than MOD, and in the male the free margin of the clypeal lobe is arcuate. The axilla is slightly expanded or not expanded in some females, and such specimens resemble *antennatus* because of the unusually broad clypeal lobe (lobe width 1.7–2.0 clypeal length), a similar sculpture of the mesopleuron, and appressed vertex setae. Details of body vestiture help in identification: in *crassiformis*, the mesopleural setae partly conceal the mesopleural integument, and the propodeal setae are oriented anterad along the midline; in *antennatus*, the mesopleural integument is easily visible, and in the western populations the setae of the propodeal dorsum are parted along the midline, diverging anterad. *Tachysphex krombeini* is also similar, but the clypeal lobe is slightly more prominent (compare Fig. 48a and 45a), and the gaster is black (all or partly red in *crassiformis*).

DESCRIPTION.—Frons microsculptured, its punctures subcontiguous to more than one diameter apart, inconspicuous in some individuals. Vertex and scutal punctures less than one diameter apart or scutal punctures several diameters apart. Reflexed marginal flange of scutum prominently expanded at posterior corner (Fig. 48b, d, e). Axilla (except some females) expanded laterally into a lobe which may be large (overhanging lateral fossa) or small, steplike; its lateral outline markedly arcuate in dorsal view (Fig. 48b, d, e). Mesopleuron finely, evenly punctate, punctures almost contiguous. Metapleural flange broadened in some specimens. Propodeal dorsum evenly microareolate; side and hindface ridged, ridges evanescent in some specimens; hindface margined above by sharp, mesally interrupted carina (which may be absent laterally in smallest specimens). Apical depression of sternum I indistinct or absent. Discal micropunctures of tergum II evanescent, two to three diameters apart. Hindcoxa carinate.

Vestiture concealing sculpture between antennal socket and orbit, partly hiding mesopleural sculpture. Setae appressed on vertex, scutum, and femora, appressed or nearly so on mesopleuron; midscutal setae variably oriented (longitudinally to transversely); setae of propodeal dorsum oriented anterad, at least on mesal zone; only a few setae oriented anterad in a female (20 mi S Portal, Arizona, CAS) whose identification is unquestionable because of the markedly expanded axilla.

Terga I–IV or (some males) I–V silvery fasciate apically. Frontal vestiture silvery. Wings almost hyaline.

♀.—Clypeus (Fig. 48a): lobe broader than in most other species (distance between lip corners 1.7–2.0 × clypeal length); bevel longer to shorter than basomedian area; lip weakly arcuate, incised laterally or entire (even in members of the same population). Dorsal length of flagellomere I 1.6–2.1 × apical width. Vertex width slightly more to slightly less than length. Tergum V with a few scattered punctures, its apical depression impunctate. Pygidial plate alutaceous, sparsely punctate. Trochanters and forefemoral venter evenly micropunctate. Length 5.5–8.0 mm.

Head and thorax black, but propodeum and thoracic venter partly red in some specimens from Portal, Arizona; gaster all red (most specimens) to almost all black (some individuals). Legs black or hindlegs largely red, and all legs red in occasional females from Portal, Arizona; tarsal apex brown.

♂.—Mandibular inner margin with tooth (Fig. 48f). Clypeus (Fig. 48f): lobe almost flat, relatively broad (distance between lip corners 1.6–1.8 × length); bevel shorter than basomedian area; lip arcuate, its corners obtuse to acute, not prominent, closer to orbit than to each other. Dorsal length of flagellomere I 1.0–1.5 × apical width. Vertex width 1.8–2.2 × length. Sterna usually densely punctate throughout, but sterna III–V sparsely punctate in some Arizona specimens. Forefemoral notch weakly pubescent. Foretarsus in most specimens without rake (see Variation for further details); outer apical spine of foretarsomere II much shorter than foretarsomere III. Length 4.0–5.5 mm.

Head, thorax, and legs black, hindtibia and tarsal apex sometimes brown. Gaster black or segments I–III red.

VARIATION.—Scutum weakly, evenly convex (most specimens

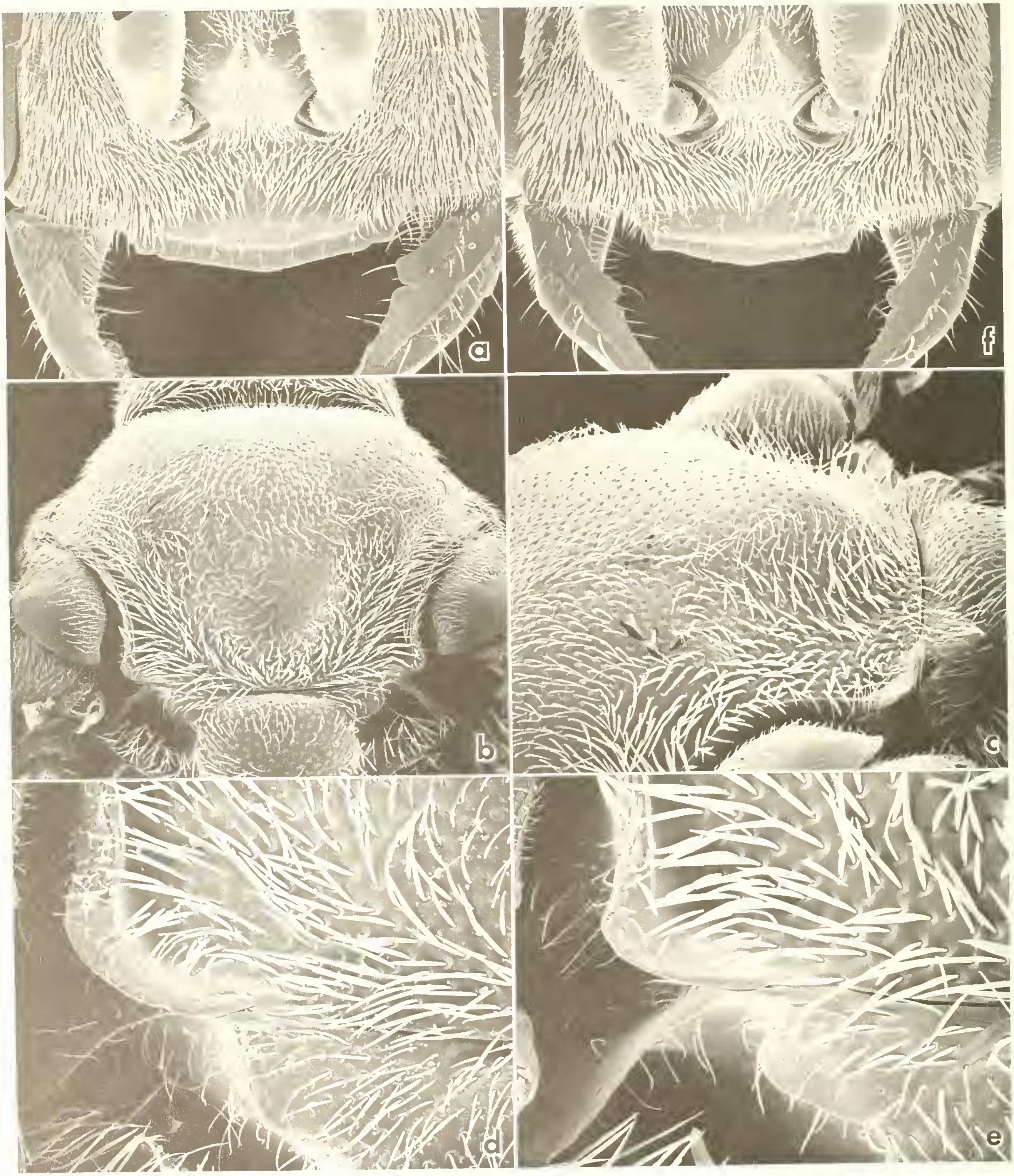

FIGURE 48. *Tachysphex crassiformis* Viereck: a—female clypeus; b—female scutum, dorsal view, c—same of a different specimen, oblique view; d—scutal hindcorner and axilla of female, weakly expanded, e—same, broadly expanded, f—male clypeus.

from United States) or with variably developed mesal gibbosity (which is high south of Mexico).

Scutal puncture in most specimens less than one diameter apart, but in some females (holotype of *crassiformis*, a specimen from Fort Collins, Colorado; one from White Rocks, Colorado; one from Continental, Arizona) most discal punctures are several diameters apart, and intermediates occur.

The foretarsal rake is usually absent in the male, but some individuals from Kill Devil Hills, North Carolina, and Death Valley Junction, California, have one or two preapical spines on the forebasitarsus. These spines may be as long as the basitarsal width.

LIFE HISTORY.—The nesting behavior of *crassiformis* was observed by Williams (1914) and Krombein (1963*a*). The species is apparently restricted to sparsely vegetated sandy areas. There are at least two generations a year. The nest has a single cell, and its entrance is left open during the provisioning period. The recorded prey are nymphal Acrididae: *Psinidia fenestralis* (Serville), *Scirtetica marmorata picta* (Scudder), and unidentified acridines (=tryxalines). Small nymphs are flown to the nest, but prey larger than the wasps are carried on the ground with occasional, short flights; they are held venter up under the body of the wasp which grasps them by their antennal bases. The number of prey per cell varies from one (Krombein) to six (Williams), according to their size. Arriving at the nest, the female flies directly to the burrow with the grasshopper (Williams, small prey) or deposits it at the entrance and then pulls it in (Krombein, large prey). The egg is attached transversely to the sternum behind the forecoxae or to the throat of the prey.

GEOGRAPHIC DISTRIBUTION (Fig. 49).—United States from North Carolina, Wyoming, Idaho, and central California south to Florida, Texas, Venezuela, and Colombia, north to southern Alberta.

MATERIAL EXAMINED.—695♀, 463♂ (including 22♀, 4♂ paratypes of *boharti*).

RECORDS.—CANADA: **Alberta:** 12 km SW Orion, Writing-on-Stone Provincial Park.

UNITED STATES. ALABAMA. **Baldwin:** Gulf Shores. **Montgomery:** Montgomery. ARIZONA: **Cochise. Coconino:** Antelope Hills (25 mi N Flagstaff), Flagstaff. **Gila:** 7 mi N Payson, Strawberry. **Graham:** Dripping Springs (Whitlock Mts.), Roper Lake State Park (6 mi S Safford). **Maricopa:** Phoenix, 3 mi SW Wickenburg (also 5 mi SE). **Mohave:** 4 mi W Chloride, Wikieup. **Pima. Pinal:** Boyce Thompson Arboretum (3 mi W Superior), 3 mi W Oracle. **Santa Cruz:** Nogales, 6 and 12 mi SW Patagonia, Sycamore Canyon. **Yavapai:** 7 mi E Cottonwood, 8 mi NE Yarnell. ARKANSAS. **Conway:** —. CALIFORNIA. **Imperial:** Glamis (also 20 mi E), Palo Verde (also 3 mi S), Picacho Recreation Area (18 mi N Winterhaven). **Inyo. Kern:** Antelope Canyon near Tehachapi. **Los Angeles:** Long Beach. **Mono:** East Walker River (13 mi NE Bridgeport). **Orange:** Laguna Canyon, Newport Beach, Santa Ana Canyon. **Riverside:** 6 mi NE Blythe (also 18 mi W), Deep Canyon (4 mi S Palm Desert), Riverside. **San Bernardino. San Diego. SantaBarbara:** Los Prietos. **Tulare:** Goshen Junction. **Ventura:** Wagon Road No. 2 Campground (18 air mi WSW Gorman). COLORADO. **Bent:** Hasty. **Boulder:** White Rocks near Boulder. **Denver:** Denver. **Larimer:** Park Creek (20 mi N Fort Collins). **Montezuma:** 3 mi W Arriola. **Provers:** Lamar. **Teller:** Florissant. **Weld:** Owl Creek (12 mi NE Nunn), Pawnee National Grassland (8 and 11 mi NE Nunn), 1 mi NE Roggen. FLORIDA. **Alachua:** Gainesville, Monteoca (11 mi NW Gainesville), San Felasco Hammock. **Citrus:** —. **De Soto:** Arcadia. **Gadsden:** Quincy. **Levy:** Cedar Key, Shell Mound. **Liberty:** Torreya State Park. **Nassau:** Fort Clinch State Park. **Putnam:** Welaka. **St. Lucie:** Fort Pierce. GEORGIA. **Liberty:** St. Catherine's Island. **McIntosh:** Sapelo Island. IDAHO: **Fremont:** 6 mi NW Saint Anthony. **Gooding:** 1 mi NE Gooding. **Owyhee:** Bruneau. KANSAS. **Ellis:** Hays. **Grant, Hamilton:** —. **Kearny:** Lakin. **Ness, Norton, Stanton:** —. MONTANA. —. NEBRASKA. **Buffalo:** 10 mi SE Ravenna. NEVADA: **Churchill:** Carson Sink, 3 mi W Hazen. **Clark:** 8 mi S Overton. **Douglas:** Teels Marsh sand dunes. **Lyon:** Fernley. **Storey:** 15 mi E Reno. NEW MEXICO: **Catron:** Glenwood, Pie Town. **Colfax:** —. **De Baca:** Sumner Lake State Park. **Dona Ana:** Las Cruces. **Eddy:** Carlsbad. **Hidalgo. Los Alamos:** Los Alamos. **Otero:** Alamogordo. **San Juan:** 43 mi S Shiprock. **Sierra:** Percha Dam State Park. **Socorro:** La Joya (20 mi N Socorro). NORTH CAROLINA. **Dare:** Kill Devil Hills, Salvo. NORTH DAKOTA. **Richland:** 13 mi W Walcott. OKLAHOMA. **Cimarron:** Black Mesa State Park. **Logan:** Guthrie. **Marshall:** Lake Texoma. SOUTH CAROLINA. **Beaufort:** Hilton Head Island. SOUTH DAKOTA. **Custer:** Black Hill National Forest. TEXAS: **Bastrop:** 6 mi E Bastrop. **Bosque:** Meridian State Park. **Brazos:** —. **Brewster:** 9 mi S Alpine, Big Bend National Park (Nine Point Draw). **Cameron:** Harlingen. **Colorado:** —. **Crockett:** Fort Lancaster State Historical Park. **Dallas:** Dallas. **Guadalupe:** Seguin. **Hidalgo:** Bentsen Rio Grande Valley State Park. **Hudspeth:** McNary. **Jeff Davis:** 10 and 23 mi W Fort Davis. **Kenedy:** 3 mi S Sarita. **Kimble:** Junction. **Kleberg:** Kingsville (also 20 mi SE). **Lee:** Fedor, Gidding. **Mitchell:** Lake Colorado City State Park. **Refugio:** Bayside. **San Patricio:** 8 and 10 mi NE Sinton. **Somervell:** Dinosaur Valley State Park. **Starr:** Rio Grande City, Roma. **Uvalde:** Nueces River. **Val Verde:** Amistad National Recreation Area, Del Rio, Devils River. **Victoria:** Victoria. **Webb:** 32 air mi N Laredo. **Wilbarger:** Vernon. **Williamson:** —. UTAH. **Cache:** Cornish, Logan. **Emery:** Calf Canyon (San Rafael Swell), San Rafael Desert (3 mi SSE Temple Mt.). **Garfield:** 4 mi N Boulder. **Millard:** Delta. **Uintah:** Green River 5 mi NE Jensen, 6 mi N Vernal. **Washington:** SW Bonanza, 1 mi W Leeds, Zion National Park. **Wayne:** Bullfrog Campground. WYOMING: **Platte:** Glendo.

MEXICO. **Baja California Norte:** Catavina, 12 km NNW El Rosario (also 16 and 21 mi ESE), 4–12 mi NE El Rosarito, 1–3 and 10 mi NE Santa Rosalillita (which is 28°47′N, 114°10′W). **Baja California Sur. Chihuahua:** Ciudad Camargo, Colonia Juárez, 10–15 km S Maycoba. **Coahuila:** 61 mi N Saltillo. **Distrito Federal:** México. **Durango:** 10 mi W Durango. **Guanajuato:** 5 mi S Guanajuato. **Guerrero:** Acapulco, Chilapa, Zumpango. **Jalisco:** Chamela, Estanzuela (40 km W Ameca), 25 mi N Guadalajara, 6 mi S Ojuelos, Plan de Barrancas. **Mexico:** Teotihuacán Pyramids. **Morelos:** 3 mi N Alpuyeca, Las Estacas. **Nayarit:** Huajicori on River Acaponeta, San Blas. **Oaxaca:** 23 mi S Matias Romero. **Puebla:** 14 mi W Huauchinango. **Queretaro:** Palmillas. **San Luis Potosi:** 20 mi E Huizache. **Sinaloa:** Chupaderos, 54 mi S Culiacán, 8 mi SE Elota, 2.5 mi S Mazatlán. **Sonora:** Alamos, Cucurpe area, La Aduana, Nogales. **Tamaulipas:** Municipio de Aldama (Rancho Nuevo), Playa Altamira. **Veracruz:** 71 mi S Panuco, Veracruz. **Zacatecas:** 10 mi S Jalpa, Rio Grande, San Juan Capistrano (22°38′N, 104°05′W).

CENTRAL AMERICA. COSTA RICA: Limon (Pulawski 1974*a*). EL SALVADOR (Pulawski 1974*a*): Los Chorros, Quezaltepeque, San Salvador. GUATEMALA: El Salto. PANAMA: Puerto Armuelles.

SOUTH AMERICA. COLOMBIA. **Magdalena:** Santa Marta (Pulawski 1974*a*). **Tolima:** Armero. VENEZUELA: **Aragua:** Lago Valencia, Ocumare de la Costa. **Falcon:** 15 km N Coro, Peninsula Paraguana (Pueblo Nuevo). **Lara:** 20 mi E Carora. **Zulia:** 6 mi W La Concepcion, 10 mi E Machiques (also 31 km SW), Maracaibo, Rosario.

Tachysphex cubanus Pulawski

(Figure 49)

Tachysphex cubanus Pulawski, 1974*a* 17, ♀, ♂. Holotype: ♀, Cuba: Oriente Province: Ciudamar near Santiago (USNM).—Bohart and Menke 1976:273.

DIAGNOSIS.—*Tachysphex cubanus* and *dominicanus*, the two Caribbean members of the *pompiliformis* group, share the following unique combination of characters: clypeal lobe broad, as in *antennatus* and its relatives (see Description below for details), and mesopleuron finely, evenly microsculptured, with inconspicuous, sparse punctures. The male mandible is unique within the *pompiliformis* group: the inner margin is broadly emarginate mesally (Fig. 50c). *Tachysphex cubanus* differs from *dominicanus* in having an arcuate clypeal lip in the female (without a median prominence) and an emarginate basally male forefemur. Also the gaster is differently colored: it is black basally and red apically in *cubanus*, whereas in *dominicanus* the female gaster is red except terga I–III or I–IV are black mesally, and the male gaster is black except terga I–III or I–IV red laterally.

DESCRIPTION.—Punctures of upper frons shallow, evanescent, several diameters apart in female, one diameter apart or less in male; averaging less than one diameter apart on vertex and scutum, but up to two or three diameters apart on scutum an-

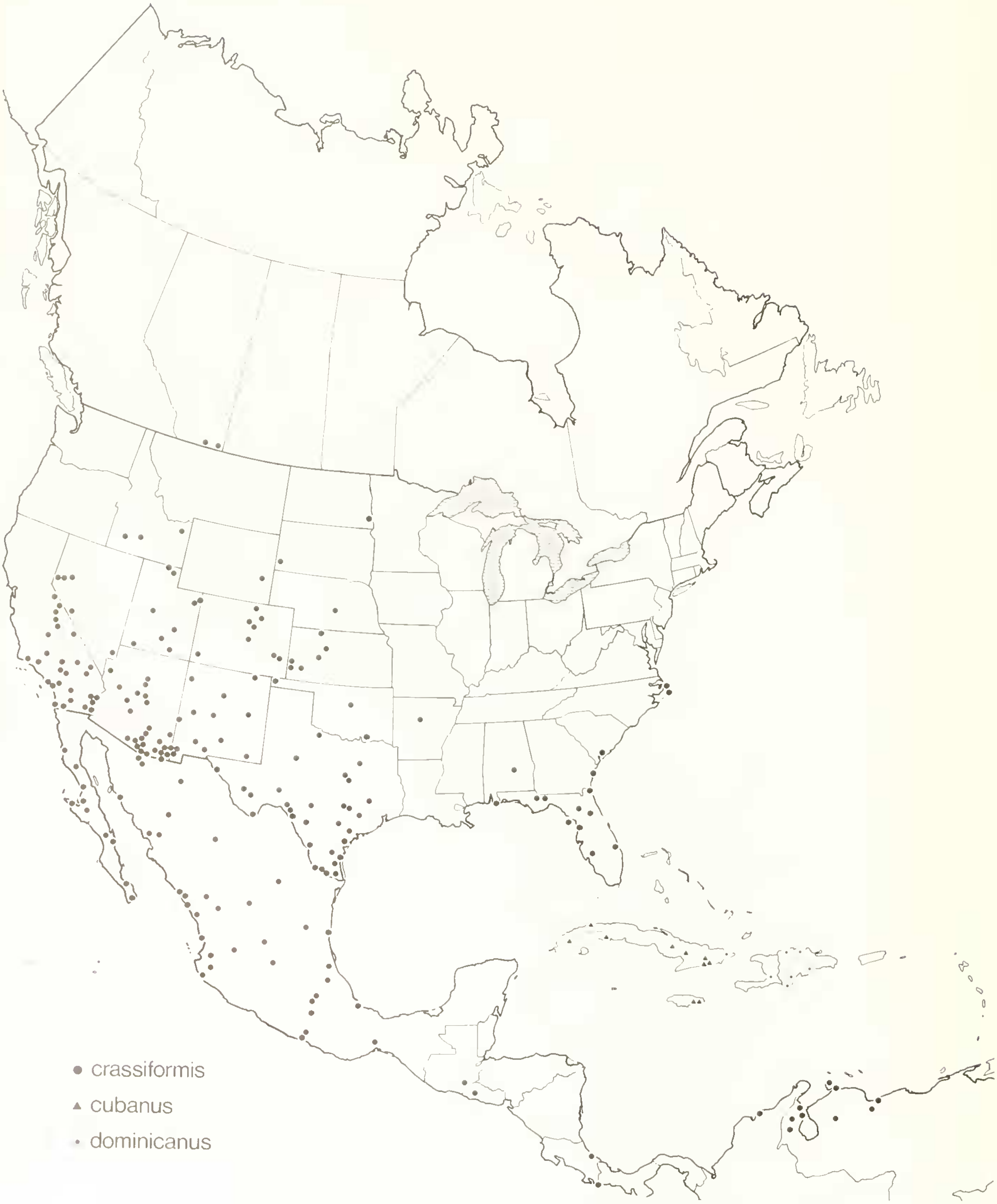

FIGURE 49. Geographic distribution of *Tachysphex crassiformis* Viereck, *cubanus* Pulawski, and *dominicanus* sp. n.

terolaterally in female; one to two diameters apart on mesothoracic venter. Mesopleuron finely, evenly microsculptured, with sparse, inconspicuous punctures. Propodeal dorsum rugose and with ill-defined ridges, side ridged (ridges evanescent in a male from Juraguá, Cuba), hindface ridged. Discal micropunctures of tergum II two to four diameters apart. Sternum II with shallow, apical depression that is not sharply delimited anteriorly. Hindcoxa carinate basally.

Integument hidden by vestiture between antennal socket and orbit when seen from most angles. Setae inclined on mesopleuron, oriented anterad on propodeal dorsum (except basally), inclined on midfemoral venter.

Head, thorax, and legs black, or tarsal apex dark reddish; mandible yellowish red mesally. Terga I–IV (female) or I–V (male) silvery fasciate apically. Wings slightly infumate, almost hyaline. Frontal vestiture silvery.

♀.—Clypeus: bevel slightly longer to slightly shorter mesally than basomedian area; lip arcuate or weakly sinuate, incised laterally; distance between lip corners 1.7–2.0 × clypeal length. Dorsal length of flagellomere I 2.0–2.25 × apical width. Vertex width 0.9–1.0 × length. Tergum V sparsely punctate, apical depression impunctate. Trochanteral venter minutely, closely punctate. Length 4.6–8.1 mm.

Vertex setae inclined, shorter than MOD except a few setae adjacent to orbit about 1.0 MOD long. Midscutal setae oriented obliquely posterad, but not forming well-defined pattern.

Terga I to I–III black, remainder red or (some specimens) dark, almost black; sterna red to black.

♂.—Inner mandibular margin with tooth, broadly emarginate distad of tooth. Clypeus: bevel about as long mesally as basomedian area; lip straight or sinuate, its corners well defined; distance between lip corners equal to 1.4–1.8 clypeal length. Dorsal length of flagellomere I 1.2–1.4 × apical width. Vertex width 1.3–1.5 × length. Sterna densely punctate throughout, punctures finer than those on mesothoracic venter. Sterna III–VI with graduli. Forebasitarsus without preapical rake spines; outer apical spine of foretarsomere II shorter than tarsomere width. Length 4.3–6.5 mm.

Vertex setae inclined or erect, shorter than MOD except a few setae adjacent to orbit about 1.0 MOD long, all setae about 1.5 MOD long in the Juraguá male; midscutal setae oriented transversely or obliquely posterad, forming a pattern.

Gaster black or (most specimens) segments IV–VI red, or all sterna brown red.

Geographic Distribution (Fig. 49).—Cuba, Jamaica.

Material Examined.—5♀, 3♂ from Cuba (paratypes), 12♀, 10♂ from Jamaica.

Records (partly from Pulawski 1974*a*).—CUBA **Camaguey:** Camaguey. **Habana:** Cojimar. **Las Villas:** Ciénaga de Zapata. **Oriente:** Ciudamar near Santiago de Cuba, Cuabitos, Juraguá, Manicaragua, Siboney and Caney near Santiago de Cuba, Tortuguilla, Versalles near Santiago de Cuba. **Pinar del Rio:** Santa Maria near San Luis

JAMAICA **Kingston Parish:** The Palisadoes. **St. Catherine Parish:** —(Pulawski 1974*a*). **St. Thomas Parish:** Yallahs.

Tachysphex dominicanus sp. n.

(Figures 49, 50)

Derivation of Name.—Dominicanus is a neo-Latin adjective derived from dies dominica, a Sunday. The feminine gender was used to name a country, and the masculine gender is here used for the new wasp species.

Diagnosis.—*Tachysphex dominicanus* is the only member of the *pompiliformis* group found in Hispaniola. The male differs from other species of the group in having a nonemarginate forefemur (although *psilocerus* also approaches this condition). The female can be recognized by the mesopleural sculpture (integument finely, evenly microsculptured, with minute, sparse punctures; Fig. 50b) combined with the shape of clypeus (lip with obtuse median projection; Fig. 50a). The gaster color is also distinctive: in the female, the gaster is red with a black median strip on terga I–III; in the male, terga are black except terga I–III or I–IV are red laterally.

Description.—Punctures of upper frons shallow, evanescent, several diameters apart in female, one diameter apart or less in male; averaging less than one diameter apart on vertex and scutum, but up to two or three diameters apart on scutum anterolaterally in female; one to three diameters apart on mesothoracic venter. Mesopleuron finely, evenly microsculptured, with sparse, inconspicuous punctures (Fig. 50b). Propodeal dorsum microareolate and with ill-defined, longitudinal ridges; side and hindface ridged. Discal micropunctures of tergum II two to four diameters apart. Sternum II with triangular depression apically. Hindcoxa carinate basally.

Integument hidden by vestiture between antennal socket and orbit when seen from most angles. Setae: inclined or erect on vertex (shorter than MOD except a few setae adjacent to orbit about 1.0 MOD long); inclined on mesopleuron; oriented anterad on propodeal dorsum (except basally); inclined on midfemoral venter.

Head, thorax, and legs black, mandibles yellowish red mesally. Terga I–IV (female) or I–V (male) silvery fasciate apically. Wings weakly infumate, almost hyaline. Frontal vestiture silvery.

♀.—Clypeus (Fig. 50a): bevel equal to basomedian area or longer; lip with a median projection (projection inconspicuous in some individuals), with one or two lateral incisions; distance between lip corners 1.7–1.8 × clypeal length. Dorsal length of flagellomere I 2.0–2.2 × apical width. Vertex width 0.8–1.2 × length. Tergum V with a few, sparse punctures, apical impression impunctate. Trochanteral venter minutely, closely punctate. Length 6.0–8.0 mm.

Midscutal setae oriented obliquely posterad, but not forming well-defined pattern.

Terga red except terga I–III or I–IV black mesally; sterna red.

♂.—Inner mandibular margin with tooth, broadly emarginate distal of tooth (Fig. 50c). Clypeus (Fig. 50c): bevel shorter than basomedian area; lip straight, weakly arcuate or weakly sinuate, its corners well defined to prominent; distance between lip corners equal to 1.4–1.5 clypeal length. Dorsal length of flagellomere I 1.2–1.5 × apical width. Vertex width 1.2–1.3 × length. Sterna densely punctate throughout, punctures finer than those on mesothoracic venter. Sterna III–VI with graduli. Forefemur entire. Forebasitarsus without preapical rake spines; outer apical spine of foretarsomere II shorter than tarsomere width. Length 4.3–6.5 mm.

Midscutal setae oriented transversely or obliquely posterad, forming a pattern.

Terga black except terga I–III or I–IV red laterally; sterna all or largely black.

Geographic Distribution (Fig. 49).—Eastern Cuba, Hispaniola.

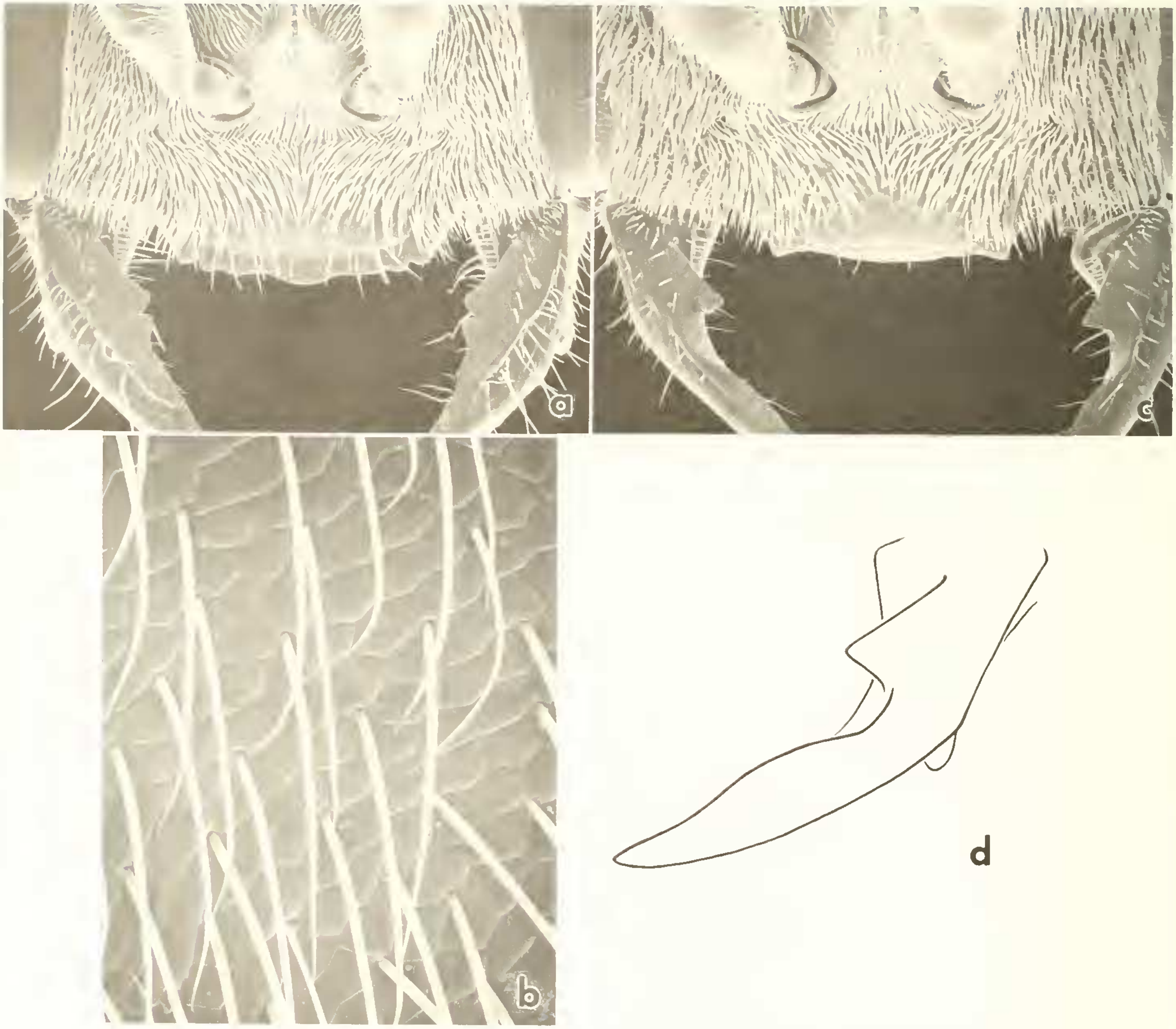

FIGURE 50. *Tachysphex dominicanus* sp. n. a—female clypeus, b—sculpture of female mesopleuron, c—male clypeus; d—male mandible.

COLLECTING PERIOD.—May, June, September–November.

MATERIAL EXAMINED.—Holotype ♂, Dominican Republic: Distrito Nacional, Haina, 1 Nov 1986, WJP (CAS, Type #15903).

Paratypes (32♀, 33♂; specimens for which depository is not indicated are all in CAS). CUBA: **Oriente:** La Farola near Baracoa, collector unknown (1♂, paratype of *Tachysphex cubanus*).

DOMINICAN REPUBLIC: **Barahona:** Barahona, WJP (1♀, 1♂), 4 km W Barahona, WJP (2♀), 7 km E Barahona, LAS (1♀, 7♀, 6♂, FSCA), 29 km E Barahona, R. E. Woodruff and LAS (1♀, FSCA), 1.6 km W Fondo Negro, R. E. Woodruff and LAS (1♂, FSCA). **Distrito Nacional:** Haina, WJP (4♀, 4♂). **Monte Christi:** 3 km N Villa Elisa, R. E. Woodruff and LAS (1♀, FSCA), 4 km W Villa Vasquez, R. E. Woodruff and LAS (1♀, FSCA). **Pedernales:** Cabo Rojo, LAS and F. Mercano (1♀, FSCA), WJP (6♀, 13♂, 2♂ MCZ). Oviedo, WJP (2♀, 5♂). **Puerto Plata:** Playa Cabarete (32 km E Puerto Plata), WJP (1♀), Punta Rucia, R. Miller and LAS (1♀, FSCA). Sosua, WJP (1♀).

HAITI: Port-au-Prince, 10 Nov 1986, WJP (2♀).

Tachysphex paiute sp. n.

(Figures 51, 53)

DERIVATION OF NAME.—Named after the Paiute Indian group of tribes of the southwestern United States; noun in apposition.

DIAGNOSIS.—*Tachysphex paiute* is unique in having the hypostomal carina expanded into a lamella (as in *lamellatus*), with adjacent setae equal to 0.5 of mandibular basal width, and the axilla steplike or expanded and overhanging the adjacent area (as in most *crassiformis*). The shape of the male clypeus is distinctive (Fig. 51b).

DESCRIPTION.—Punctures no more than one diameter apart on frons, vertex, one to two diameters apart on scutal disk, varying from about one to two or three diameters apart on each side of mesothoracic venter. Mesopleuron dull or shiny, with

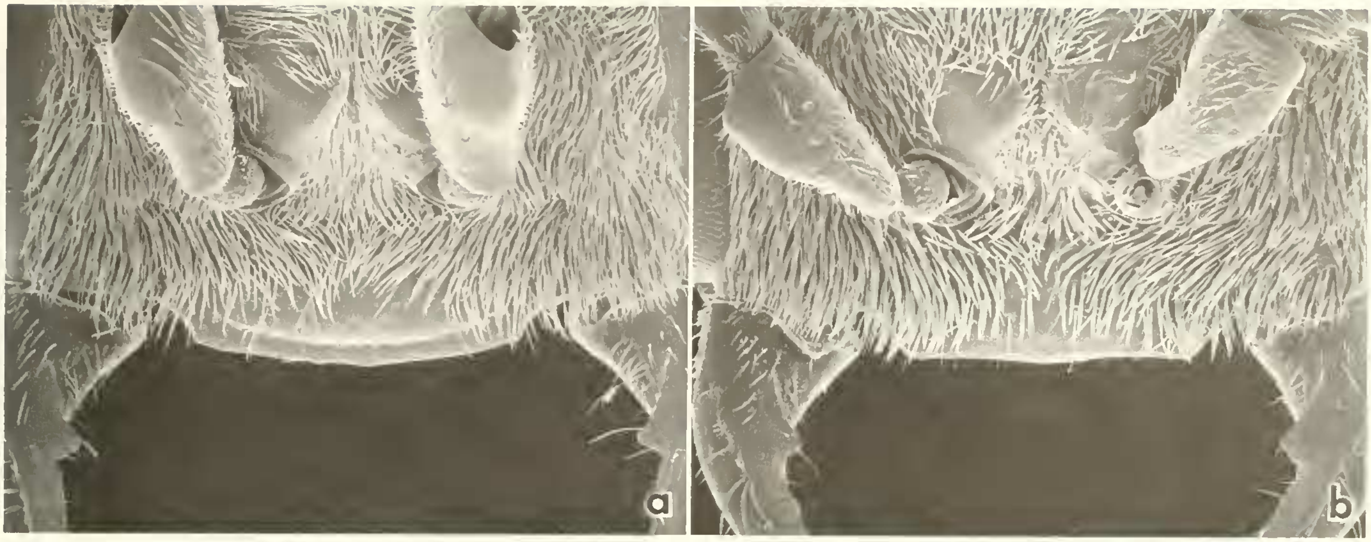

FIGURE 51. *Tachysphex paiute* sp. n.: a—female clypeus; b—male clypeus.

well-defined punctures that are less than one to more than one diameter apart. Propodeal dorsum areolate, side ridged (weakly so in two of the three males examined), hindface ridged. Sternum I with apical depression. Hindcoxa carinate basally.

Setae concealing integument between antennal socket and orbit; suberect to subappressed on vertex, suberect on mesopleuron, oriented anterad on propodeal dorsum mesally, subappressed on midfemoral venter; setae adjacent to hypostomal carina as long as 0.5 of basal width of mandible; midscutal setae oriented obliquely posterad to nearly laterad.

Head, thorax, and legs black or apical tarsomeres reddish. Gaster red; terga I–IV (I–V in male) silvery fasciate apically. Frontal vestiture silvery. Wings hyaline.

♀.—Clypeus unusually broad (Fig. 51a): distance between lip corners 1.8–2.2× clypeal midline, and 1.6–1.7× distance between lip corner and orbit; free margin of lip almost straight, without median notch or lateral incision; bevel shorter than basomedian area. Dorsal length of flagellomere I 2.5–2.8× apical width. Vertex width 0.9–1.1× length. Discal micropunctures of tergum II several diameters apart. Tergum V sparsely punctate, apical depression impunctate. Pygidial plate alutaceous, sparsely punctate. Mid- and hindtrochanteral venter sparsely punctate (sparsely punctate area evanescent in one female from Antelope Springs). Femora densely microsculptured, but sculpture evanescent near base. Length 7.0–7.7 mm.

♂.—Mandibular inner margin with tooth (Fig. 51b). Clypeus (Fig. 51b): free margin of lobe nearly straight; lobe corners well defined, 1.4× as far from each other as corner is from orbit and 2.2× clypeal length; lip not or scarcely differentiated from bevel; the latter markedly shorter than basomedian area. Dorsal length of flagellomere I 2.1–2.3× apical width. Vertex width 1.3–1.6× length. Sterna uniformly punctate or sterna II and III largely impunctate mesally; punctures finer than those of mesothoracic venter. Forefemoral notch with conspicuous setae. Forebasitarsus with two or three preapical rake spines. Outer apical spine of foretarsomere II slightly longer than tarsomere width. Length 5.0–6.0 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 53).—Death Valley area in California to Baja California Sur, Mexico.

COLLECTING PERIOD.—30 March to 1 April (Baja California), 17 April to 4 June (California).

MATERIAL EXAMINED.—Holotype: ♀, California: Inyo Co.: Antelope Springs, 24 Aug 1960, PDH (CIS, on indefinite loan to CAS, CAS Type #15907).

Paratypes (5♀, 3♂): UNITED STATES: CALIFORNIA: **Imperial:** Chocolate Mts., Ogilby Road 3 mi S junction Highway 78, 16–22 Oct 1977, MSW (1♀, CSDA). **Inyo:** same data as holotype (1♀, CIS), Eureka Valley, May 1978, D. Giuliani, A. Hardy, F. G. Andrews (1♂, CSDA); Eureka Valley, 12 mi N 10 mi W Sand Dunes, 6 May–4 June 1979, D. Giuliani (1♂, CSDA); Little Lake, 20 May 1951, EIS (1♀, UCD, gaster missing), Owens Lake Valley, 17 Apr–18 May 1978, F. G. Andrews, A. Hardy, D. Giuliani (1♀, CAS).

MEXICO: **Baja California Sur:** 35 km S Mulege, L. D. French and E. A. Sugden, 30 Mar 1980 (1♀, CAS), 1 Apr 1980 (1♂, UCD).

Tachysphex pinal sp. n.

(Figures 52, 53)

DERIVATION OF NAME.—Named after the Pinal Apache Indians of Arizona; a noun in apposition. Also an allusion to Pinal County and the mining town of Pinal, now the site of Boyce Thompson Arboretum, where the holotype was collected.

DIAGNOSIS.—*Tachysphex pinal* has an unusually broad clypeal lobe (Fig. 52a, b): the distance between the corners equals 1.7–1.9× clypeal length in the female and 1.5–1.6 in the male. The clypeus is also unusually broad in *antennatus, crassiformis, krombeini, paiute,* and *toltec,* but the erect vertex setae of *pinal* separate it from all these species except *toltec.* Other important characters are: axilla evenly rounded (axilla expanded or steplike in *paiute* and most *crassiformis*), midscutal setae oriented laterad or nearly so, forming a conspicuous pattern (scutal setae oriented posterad in *antennatus*). In the female, the vertex width is 1.0–1.1× length and the gaster is all red (in the female of *toltec,* the vertex width is 1.3–1.5× length, and the gaster is black basally and red apically). In the male, the preapical flagellomeres are the usual length, and the forefemoral notch is the usual size (the preapical flagellomeres of *toltec* are unusually short, Fig. 54c, and the forefemoral notch is unusually large,

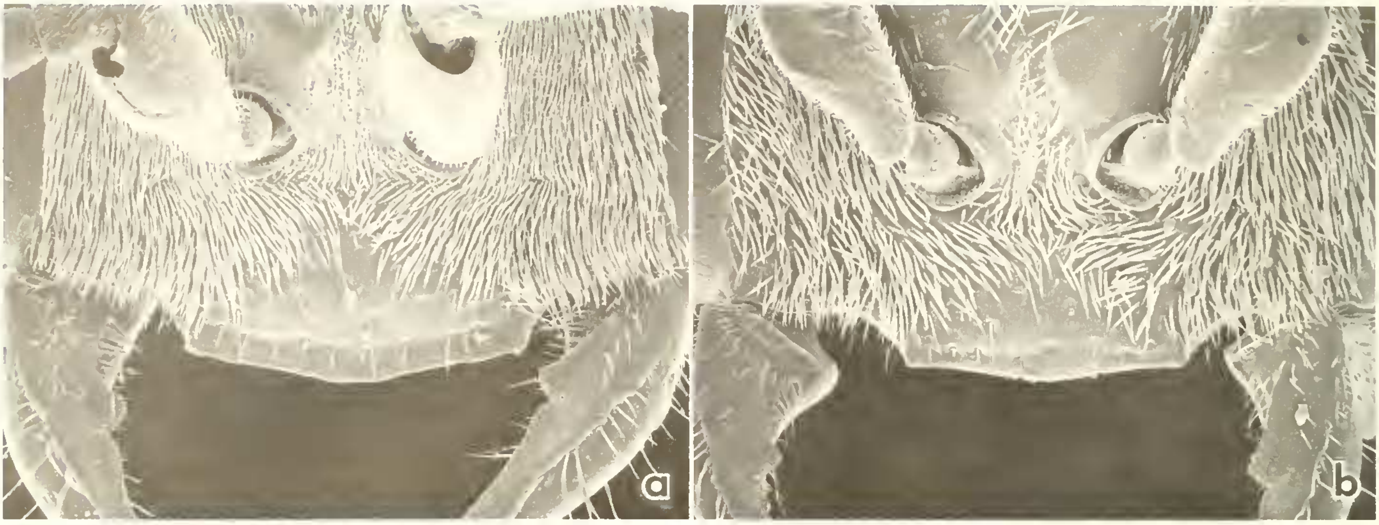

FIGURE 52. *Tachysphex pinal* sp. n. a—female clypeus; b—male clypeus.

Fig. 54d). An undescribed phenon from southern California and Nevada resembles *pinal* in the shape of clypeus and in having erect vertex setae, but unlike *pinal* its scutal setae are oriented uniformly posterad.

DESCRIPTION.—Punctures averaging about one diameter apart on frons, varying from about one to several diameters apart on vertex; up to two or three diameters apart on mesothoracic venter; on scutum, largest interspaces between punctures varying from about one (some females, many males) to many puncture diameters. Propodeal dorsum microareolate, slightly sloping apically toward transverse carina that separates it from hindface; side finely, densely ridged; hindface ridged. Micropunctures of tergum II several (female) to few (male) diameters apart. Sternum II at most with ill-defined apical depression. Hindcoxa carinate (carina not expanded into tooth).

Integument hidden by vestiture between antennal socket and orbit. Setae erect, about 1.5 MOD long, on vertex; about 1.0 MOD long and oriented transversely on midscutum (or anterolaterad, or posterolaterad, or radially in some specimens); inclined on mesopleuron; oriented anterad on propodeal dorsum along midline; nearly appressed on midfemoral venter.

Head, thorax, and legs black; mandible reddish yellowish mesally; apical tarsomeres brown. Gaster all red (female) or (most males) three or four apical segments black; gaster all black in the only male examined from Wyoming. Terga I–IV (female) or I–V (male) silvery fasciate apically; apical fascia broadly interrupted mesally. Wings hyaline. Frontal vestiture silvery.

♀.—Clypeus (Fig. 52a): bevel as long mesally as basomedian area or longer; lip weakly sinuate, incised laterally in most specimens, but entire in some; distance between lip corners 1.7–1.9 × clypeal length. Dorsal length of flagellomere I 2.0–2.2 × apical width. Vertex width 1.0–1.1 × length. Tergum V sparsely punctate, apical depression impunctate. Trochanteral venter minutely, closely punctate. Length 7.0–8.0 mm.

♂.—Inner mandibular margin with tooth (Fig. 52b). Clypeus (Fig. 52b): bevel shorter than basomedian area; lip straight, arcuate, or weakly sinuate, its corners well defined to prominent; distance between lip corners equal to 1.5–1.6 clypeal length. Dorsal length of flagellomere I 1.6–2.0 × apical width. Vertex width 1.5–1.8 × length. Sterna densely punctate throughout, punctures finer than those on mesothoracic venter. Forebasitarsus without preapical rake spines; outer apical spine of foretarsomere II shorter than tarsomere width. Length 5.0–6.0 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 53).—Southwestern Wyoming, Utah, Arizona, New Mexico, southwestern Texas, California, and Baja California, and State of Sonora in Mexico; xeric habitats.

COLLECTING PERIOD.—24 February (Sonora, Mexico), 17 March (Baja California) to 2 July (Wyoming).

MATERIAL EXAMINED.—Holotype ♀, Arizona, Pinal Co.: Boyce Thompson Arboretum 3 mi W Superior, 26 May 1985, WJP (CAS, Type #15912).

Paratypes (47♀, 87♂). UNITED STATES. ARIZONA: **Cochise:** Portal, 23 Apr 1985, WJP (1♀, 2♂, CAS). 14 mi W Tombstone, 16 Apr 1965, FDP (1♀, 2♂, BMNH, 2♀, 2♂, CAS, 10♀, 39♂, UCD, 1♀, 2♂, USNM). 2 mi E Texas Canyon, 11 May 1985, A. D. Telford (2♀, UCD). 3 mi E Willcox, 17 Apr 1986, WJP (1♂, CAS). **Coconino:** Antelope Hills [locality not found on available maps], 10 May 1978, R. C. Miller (1♂, UCD). **Graham:** Roper Lake State Park, 15 Apr 1986, WJP (1♀, CAS). **Mohave:** Wikieup, 18 May 1986, WJP (1♀, CAS). **Pima:** 8 mi SE Continental, 2 Apr 1986, TLG (1♂, USU). Sabino Canyon in Santa Catalina Mountains, 6 Apr 1957, G. Butler and F. Werner (1♀, UCD). 27 mi SE Tucson, 29 May 1965, MEI (1♀, UCR). **Pinal:** same data as holotype (3♀, CAS). **Santa Cruz:** 5 km W Arivaca Junction, 2 Apr 1986, TLD (1♂, CAS). 12 mi SW Patagonia, 22 Apr 1985, WJP (1♂, CAS). CALIFORNIA: **El Dorado:** 3 mi S Camino, 26 June 1948, JWMS (1♀, UCD). **Inyo:** 3 mi W Lone Pine, 15 May 1970, RMB (1♀, UCD). **Placer:** Martis Valley, 1 July 1964, FDP (1♀, UCD). **Riverside:** 5 mi N Blythe, 24 March 1968, D. S. Horning (1♂, UCD). Chino Canyon 3 mi W Palm Springs, 30 March 1970, EEG and R. F. Denno (1♂, UCD). **San Bernardino:** 4 mi S Baker, 23 Apr 1969, MSW and J. S. Wasbauer (2♂, CSDA). 8 mi NE Cima, 19 May 1986, WJP (1♂, CAS); Granite Mountains, 9 June 1980, TLG (TLG). 12 mi SE Ivanpah, 1 May 1956, PDH (1♀, 11♂, UCD). 7 mi SW Kelso, 16 Apr 1969, MSW and J. S. Wasbauer (1♂, CAS, 2♂, CSDA). Providence Mountains State Park, 28 May 1985, WJP (6♀, 2♂, CAS). NEW MEXICO: **Catron:** Glenwood, 1 June 1965, RMB (1♀, UCD). **Lincoln:** Valley of Fires State Park, 22 May 1985, WJP (1♂, CAS). **Sierra:** Percha Dam State Park, 21 Apr 1986, WJP (1♂, CAS). TEXAS (all 1986, TLG): **Brewster:** Big Bend National Park, Government Spring, 13 Apr (2♀, USU). Oak Creek, 14 Apr (1♀, USU). **Culberson:** 26 km N Van Horn, 9 Apr (1♀, 3♂, CAS, 1♀, 3♂, USU). Guadalupe National Park (SE corner), 7 Apr (1♀, USU). Guadalupe National Park (junction of Highway 62 and McKittrick Canyon Road), 8 Apr (1♂, CAS). UTAH: **Carbon:** Price, 26 May 1967, G. F. Knowlton (1♀, USU). **Washington:** Paradise Canyon, 24–28 May 1983, Dan Beck (2♀, CAS, USU). WYOMING: **Sweetwater:** Green River, 2 July 1920, collector unknown (1♀, UCD).

MEXICO: **Baja California Norte:** 21 mi ESE El Rosario, 17 Mar 1984, WJP (1♀, CAS). **Baja California Sur:** 30 mi ESE Bahia Tortugas, 26 Mar 1984 (1♀, CAS); eastern edge of Sierra Placeres, 27°35′N, 114°30′W, 24 Mar 1984, WJP (1♂, CAS). **Sonora:** Alamos, 24 and 26 Feb 1963, PHA (2♂, CAS).

Tachysphex toltec sp. n.

(Figures 53, 54)

Derivation of Name.—Named after the Toltec Indians of Mexico whose capital was Teotihuacán (where the holotype was collected); noun in apposition.

Diagnosis.—Like *pinal*, *toltec* has a broad clypeal lobe (distance between lip corners equal to 1.7–1.8 clypeal length in the female and 1.4–1.5 in the male; Fig. 54a, b) and erect vertex setae. The female of *toltec* can be recognized by the characters given under *pinal* (page 81). In the male, the apical flagellomeres are shorter than in other species (Fig. 54c); for example, the maximum length : maximum width ratio of flagellomere VIII is about 1.1 in *toltec*, about 1.5–1.9 in *antennatus*, and 1.8 in *crassiformis*. Another diagnostic feature of the male is its unusually deep, densely pubescent forefemoral notch (Fig. 54d, e).

An undescribed phenon from central and southern Mexico resembles *toltec* in size, sculpture, and pilosity (some specimens were also collected in Teotihuacán). Unlike *toltec*, the female has nearly appressed vertex setae and an all black gaster; in the male, the apical flagellomeres are not shortened, and the forefemoral notch is smaller and shallower; in both sexes, the corner of the clypeal lobe is less prominent than in *toltec*.

Description.—Punctures nearly contiguous on frons; in most specimens averaging no more than one diameter apart on vertex, scutum and mesothoracic venter, but averaging one to two diameters apart on vertex and scutal disk in a female from Durango area. Mesopleuron dull, microsculptured, with shallow, inconspicuous punctures. Propodeal dorsum microareolate, sloping toward transverse carina that separates it from hindface; side dull, microareolate, in most specimens microridged when seen from certain angles; hindface ridged or (some males) ridges evanescent. Discal micropunctures of tergum II several (female) or few (male) diameters apart. Sternum I at most with ill-defined apical depression. Hindcoxa carinate basally.

Integument hidden by vestiture between antennal socket and orbit as examined from most angles. Setae erect, 1.0 MOD long, on vertex; oriented transversely on midscutum; inclined on mesopleuron; on propodeal dorsum inclined anterolaterad or (some males) oriented anterad along midline; on midfemoral venter in apical half almost appressed (female) or almost erect (male).

Head, thorax, and legs black, tarsal apex brown. Terga I–III silvery fasciate apically. Wings weakly infumate (female) or nearly hyaline (male). Frontal vestiture silvery.

♀.—Clypeus (Fig. 54a): bevel mesally longer than basomedian area; lip weakly sinuate, excised laterally; distance between lip corners 1.7–1.8 × clypeal length. Dorsal length of flagellomere I 1.9–2.0 × apical width. Vertex width 1.3–1.5 × length. Tergum V sparsely punctate mesally, apical depression impunctate. Trochanteral venter closely punctate. Forebasitarsus with six rake spines; only two apical spines with confluent basal fossae. Length 7.0–7.5 mm.

Gastral segment I black, II–IV black or largely red, V and VI red.

♂.—Inner mandibular margin with tooth (Fig. 54b). Clypeus (Fig. 54b): bevel shorter than basomedian area; lip nearly straight, with prominent corners that are separated by a distance equal

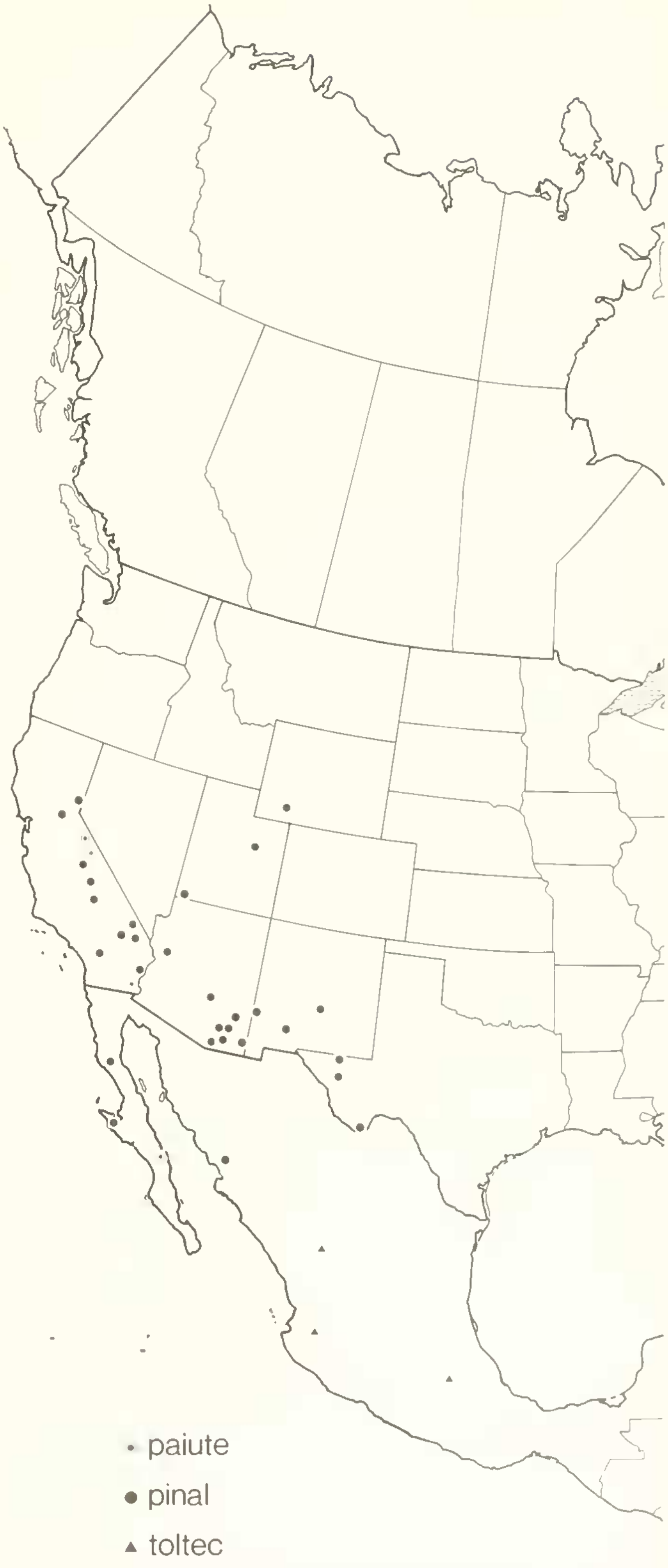

Figure 53. Geographic distribution of *Tachysphex paiute* sp. n., *pinal* sp. n., and *toltec* sp. n.

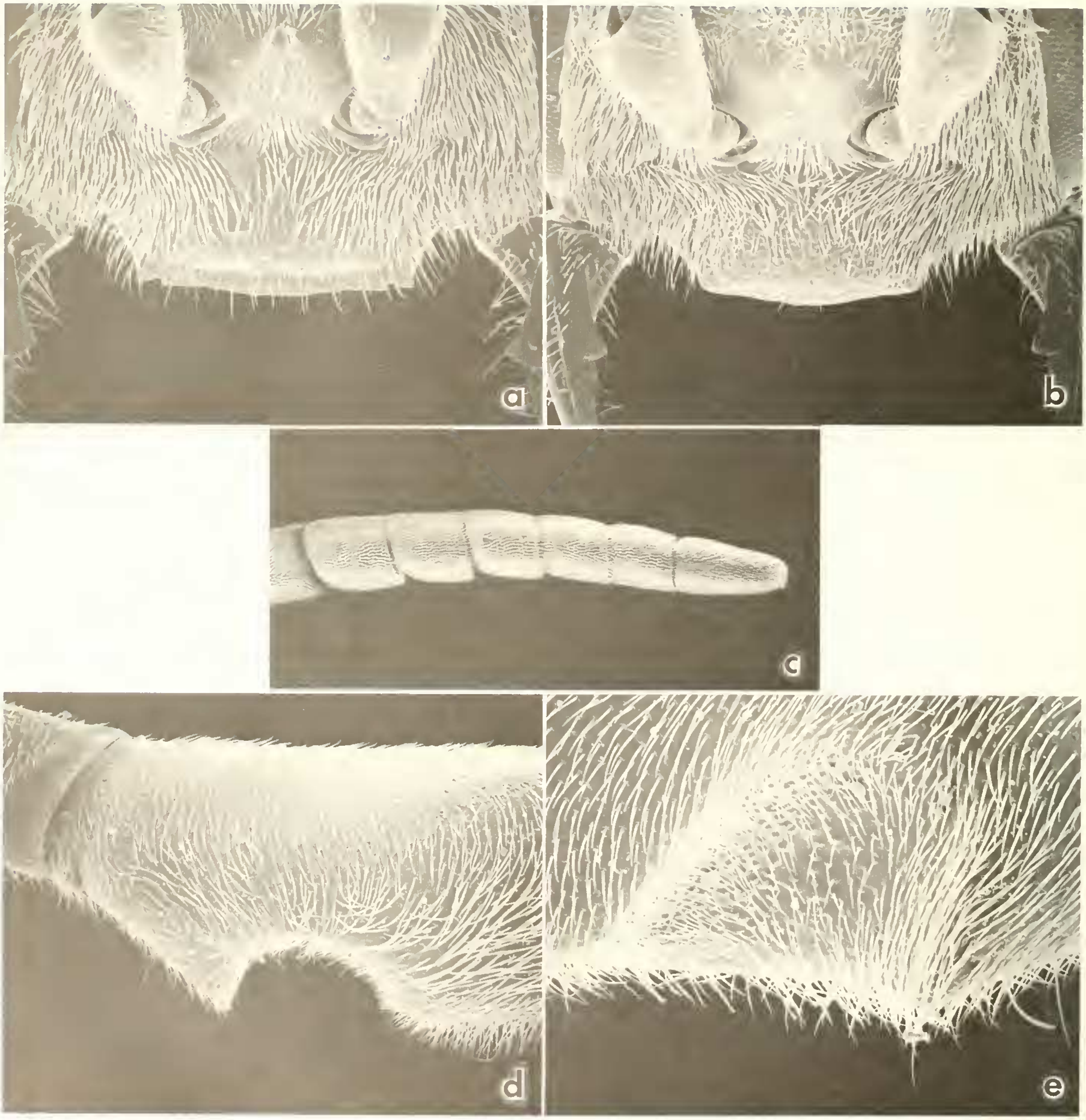

FIGURE 54. *Tachysphex toltec* sp. n.: a—female clypeus, b—male clypeus, c—apical flagellomeres of male, d—forefemoral notch of male; e—surface of the forefemoral notch.

to 1.4–1.5 of clypeal length. Dorsal length of flagellomere I 1.4–1.7 × apical width. Apical flagellomeres (Fig. 54c) shorter than in other species (e.g., maximum width : length ratio of flagellomere VIII is about 1.1). Vertex width 1.7–1.9 × length. Sterna densely punctate throughout, punctures finer than those on mesothoracic venter. Forefemoral notch deep (about one-third of femoral diameter), covered with dense, conspicuous pruinosity (Fig. 54d, e). Forebasitarsus without preapical rake spines; outer apical spine of foretarsomere II markedly shorter than tarsomere width. Length 5.3–6.7 mm.

Gastral segments IV–VII dark, tergum I partly black (almost entirely in some specimens), remainder red or partly black.

GEOGRAPHIC DISTRIBUTION (Fig. 53).—Central Mexico.

COLLECTING PERIOD.—17 June to 26 July.

MATERIAL EXAMINED.—Holotype: ♂, Mexico, México State: Teotihuacán pyramids, 15 June 1951, PDH (CIS, on indefinite loan to CAS, CAS Type #15909).

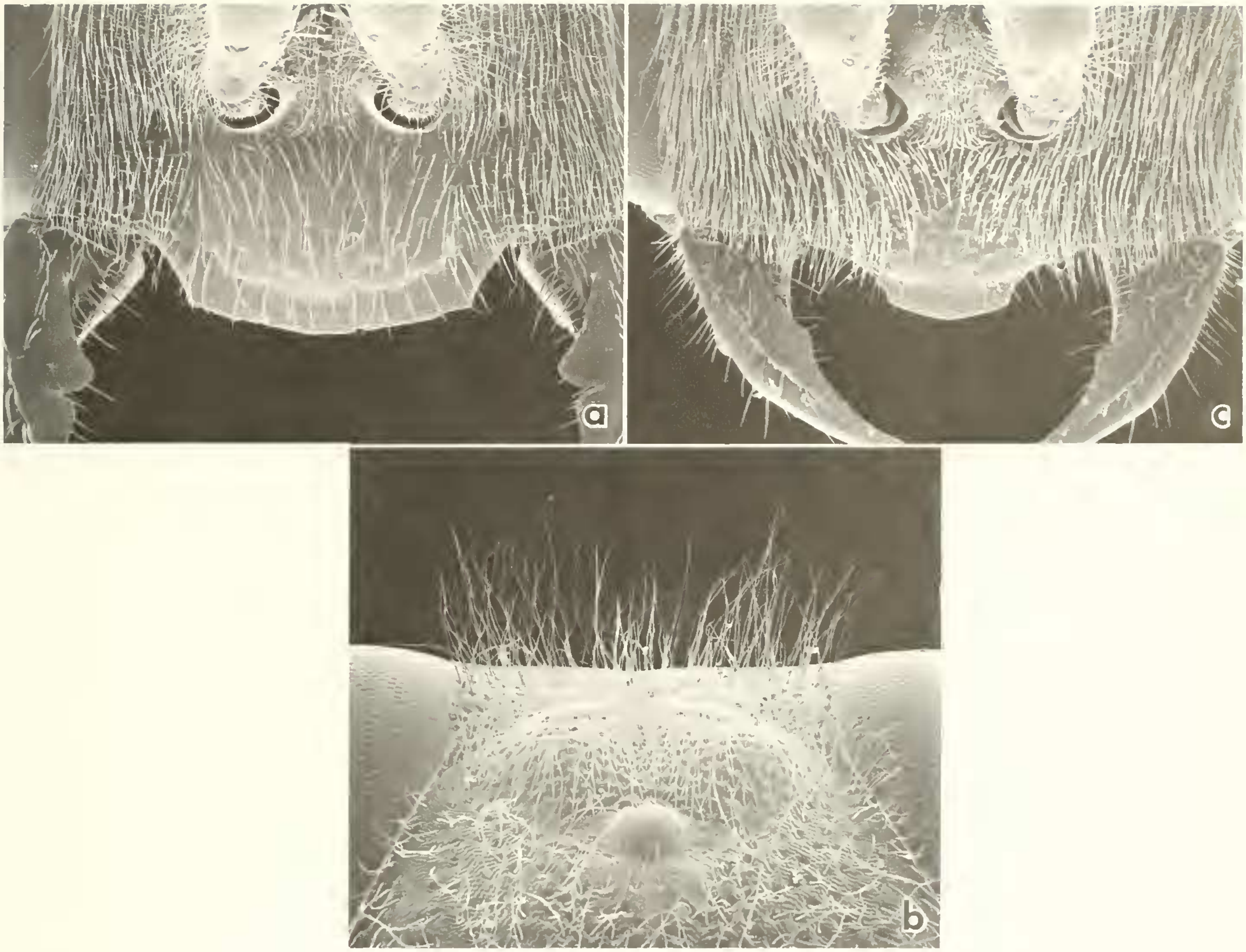

FIGURE 55. *Tachysphex idiotrichus* Pulawski: a—female clypeus; b—female vertex; c—male clypeus.

Paratypes (3♀, 8♂): MEXICO: **Durango:** 7 mi W Durango, 26 July 1964, W. R. Mason (1♀, CNC); 10 mi W Durango, 12 July 1954, JWMS (1♀, 1♂, CIS). **Jalisco:** 40 mi W Guadalajara, 18 June 1963, H. A. Scullen and D. D. Bollinger (1♀, OSU). **México:** same data as holotype (1♀, 2♂, CAS, 5♂, CIS).

Tachysphex idiotrichus Pulawski

(Figures 55, 56)

Tachysphex idiotrichus Pulawski, 1982:31, ♀, ♂. ! Holotype: ♀, Arizona: Cochise Co.: Southwestern Research Station 5 mi W Portal (UCD).

DIAGNOSIS.—*Tachysphex idiotrichus* differs from other North American species of the *pompiliformis* group in having unusually long setae on the head (Fig. 55b), thorax, and femora; the large punctures on the middle section of the female clypeus (also basally); the presence of graduli on sterna III–V of the female; and the sparsely punctate (except apex) male tergum VII. Subsidiary diagnostic characters are: sparsely punctate vertex; and in the male, vertex width more than twice length (like *pechumani*), presence of graduli on sterna III–VI (like *ashmeadii, glabrior, irregularis,* and *verticalis*), and compressed forefemoral notch (like *apricus*).

DESCRIPTION.—Frons dull, strongly microreticulate, with shallow punctures that are less than one diameter apart. Vertex and scutal disk microreticulate, punctures averaging two to four diameters apart (but subcontiguous on vertex anteriorly). Mesopleuron dull, strongly microareolate, with shallow, inconspicuous punctures that are more than one diameter below scrobe, irregularly rugose above in some individuals. Propodeal dorsum microareolate, side and hindface ridged (side ridges partly evanescent in male). Sterna III–V (also VI in male) with graduli. Hindcoxa carinate basally.

Head, thorax, and legs black. Tergum I black (except usually red apically), remaining terga red. Sternum I black, sterna II–V black mesally, remainder red (red zone small on sternum II but large on V). Terga I–III (also IV in male) weakly, silvery fasciate apically. Wings hyaline. Frontal vestiture silvery.

♀.—Clypeus (Fig. 55a): middle section with large punctures, shiny apically, dull, microreticulate basally; lip without mesal notch or lateral indentations; several punctures of lateral section more than one diameter apart. Dorsal length of flagellomere I 2.6–3.0 × apical width. Vertex width 1.3–1.5 × length. Punctures of mesothoracic venter mostly close to each other, but averaging two to three diameters apart in California specimens. Micropunctures of tergum II several diameters apart posteromedially,

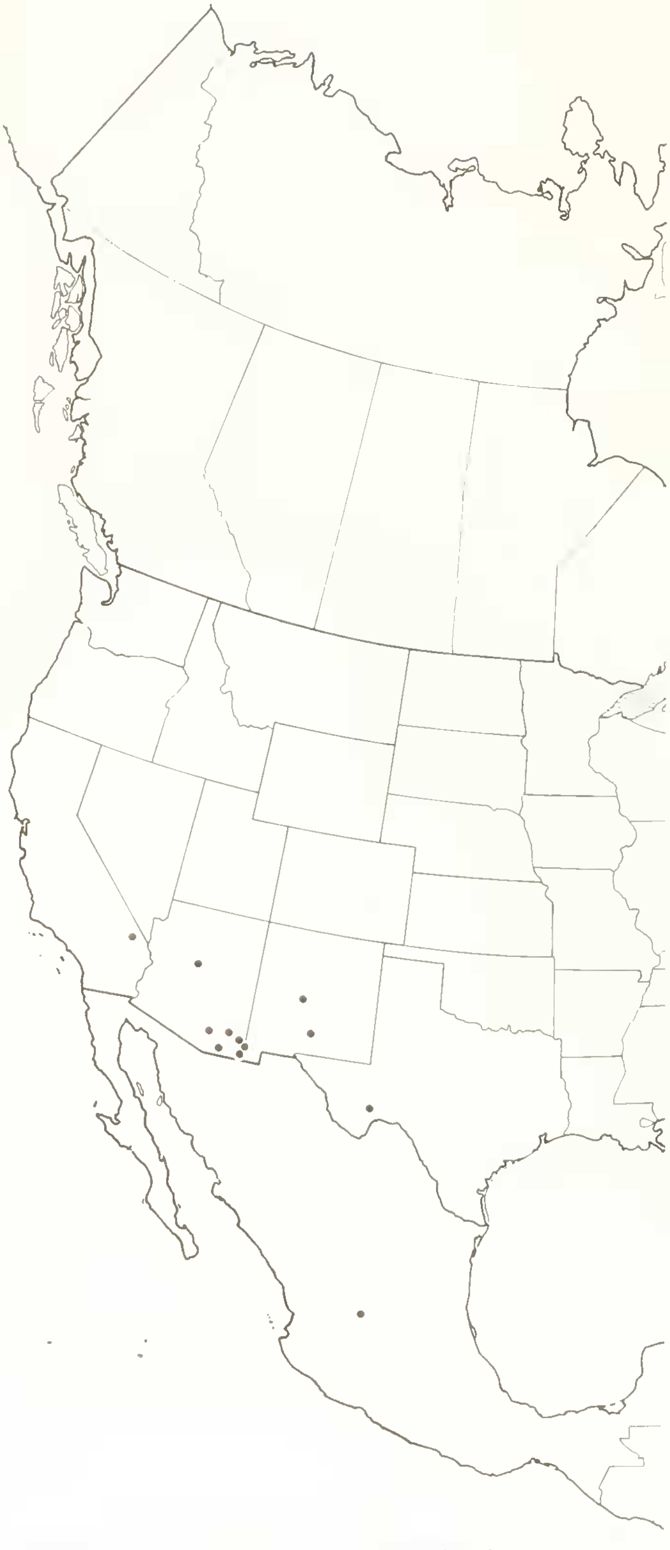

FIGURE 56. Geographic distribution of *Tachysphex idiotrichus* Pulawski.

absent on apical depression; tergum V usually with a few, sparse punctures, but densely punctate (except medially) in some specimens. Trochanteral venter alutaceous, punctate; forefemoral venter strongly microsculptured, with shallow, indistinct punctures. Length 10.0–10.5 mm.

Vestiture not obscuring integument between antennal socket and orbit. Setal length (in MOD): 2.0–2.5 on outer face of scape, 2.5–3.0 on vertex (Fig. 55b), 2.5 on lower gena, 2.0 on scutum anteriorly and on midfemoral venter (sometimes only a few midfemoral setae are this long).

♂.—Mandibular inner margin with obtuse tooth (Fig. 55c). Clypeus (Fig. 55c): bevel much shorter than basomedian area; lip arcuate, its corners indistinct, more than twice closer to each other than to orbits. Dorsal length of flagellomere I 1.9–2.2× apical width. Vertex width about 2.3× length. Tergum V with a few, sparse punctures, except densely punctate apically. Most punctures of sterna III–VI more than one diameter apart. Forefemoral notch compressed, so that its glabrous bottom forms an obtuse, longitudinal crest. Forebasitarsus with up to five preapical spines that are equal to forebasitarsal width or slightly longer. Outer apical spine of foretarsomere II as long as foretarsomere III. Length 7–8 mm.

Vestiture obscuring sculpture between antennal socket and orbit when seen from some angles. Setal length (in MOD): 1.5–2.0 on outer face of scape, 2.2–3.0 on vertex, 1.5–2.0 on lower gena and scutum anteriorly, 1.0–2.0 on midfemoral venter.

GEORAPHIC DISTRIBUTION (Fig. 56).—Low mountain areas of southwestern Texas, New Mexico, Arizona, and southern California south to Jalisco State, Mexico.

MATERIAL EXAMINED.—25♀, 11♂ (AMNH, BMNH, CAS, CSU, TLG, UAE, UAT, UCD, USNM).

RECORDS.—UNITED STATES: ARIZONA: **Cochise:** 3 mi E Apache, 2 mi W Chiricahua National Monument, 2 mi SW Portal (also 5 mi W), Sulphur Spring Valley, 14 mi W Tombstone, 1 mi SE Willcox. **Pima:** Tucson. **Yavapai:** Cottonwood (also 7 mi N). CALIFORNIA: **San Bernardino:** Mid Hills (9 mi SSE Cima). NEW MEXICO: **Hidalgo:** Rodeo to Road Forks. **Otero:** Alamogordo. **Socorro:** 10 mi W Socorro. TEXAS: **Pecos:** —.

MEXICO: **Jalisco:** Lagos de Moreno.

Tachysphex tahoe sp. n.

(Figures 57–58)

DERIVATION OF NAME.—Tahoe is a Washo Indian name meaning big water; noun in apposition. An allusion to the type locality which is in the Lake Tahoe area.

DIAGNOSIS.—Females of *tahoe* have ill-defined mesopleural punctures (Fig. 57b, c), inclined hypoepimeral setae, and the clypeal lip is entire (Fig. 57a). This combination is also found in *apricus*, *occidentalis*, and *solaris*, but their femora and tibiae are all or partly red (see these species for further differences). In *tahoe*, the femora and tibiae are black. Also, the setae of the propodeal dorsum of *tahoe* are inclined anterolaterad in dorsal view and anterad in lateral view (erect or nearly so in *semirufus*), the mesopleural setae are shorter and more inclined than in *semirufus*, and terga I–IV of most specimens are weakly fasciate apically (not fasciate in *semirufus*). The clypeal lip is weakly sinuate, Figure 57a (evenly arcuate in *miwok*), and the vertex setae are erect, possibly with exceptions (appressed in *miwok*).

In the male of *tahoe*, sterna III–VI are velvety pubescent, the clypeal lip is triangular (Fig. 57d), the inner mandibular margin is not dentate (Fig. 57d), and the mesopleuron lacks well-defined punctures. *Tachysphex musciventris* shares these features, but in *tahoe* hypoepimeral setae are inclined, and pubescence of sternum II is not velvety, not obscuring integument, thus contrasting with the following sterna. In addition, the vertex width equals 1.1–1.4× length in *tahoe* and 1.3–2.0× in *musciventris*.

DESCRIPTION.—Punctures subcontiguous on frons, scutum, and mesothoracic venter, no more than one diameter apart on ver-

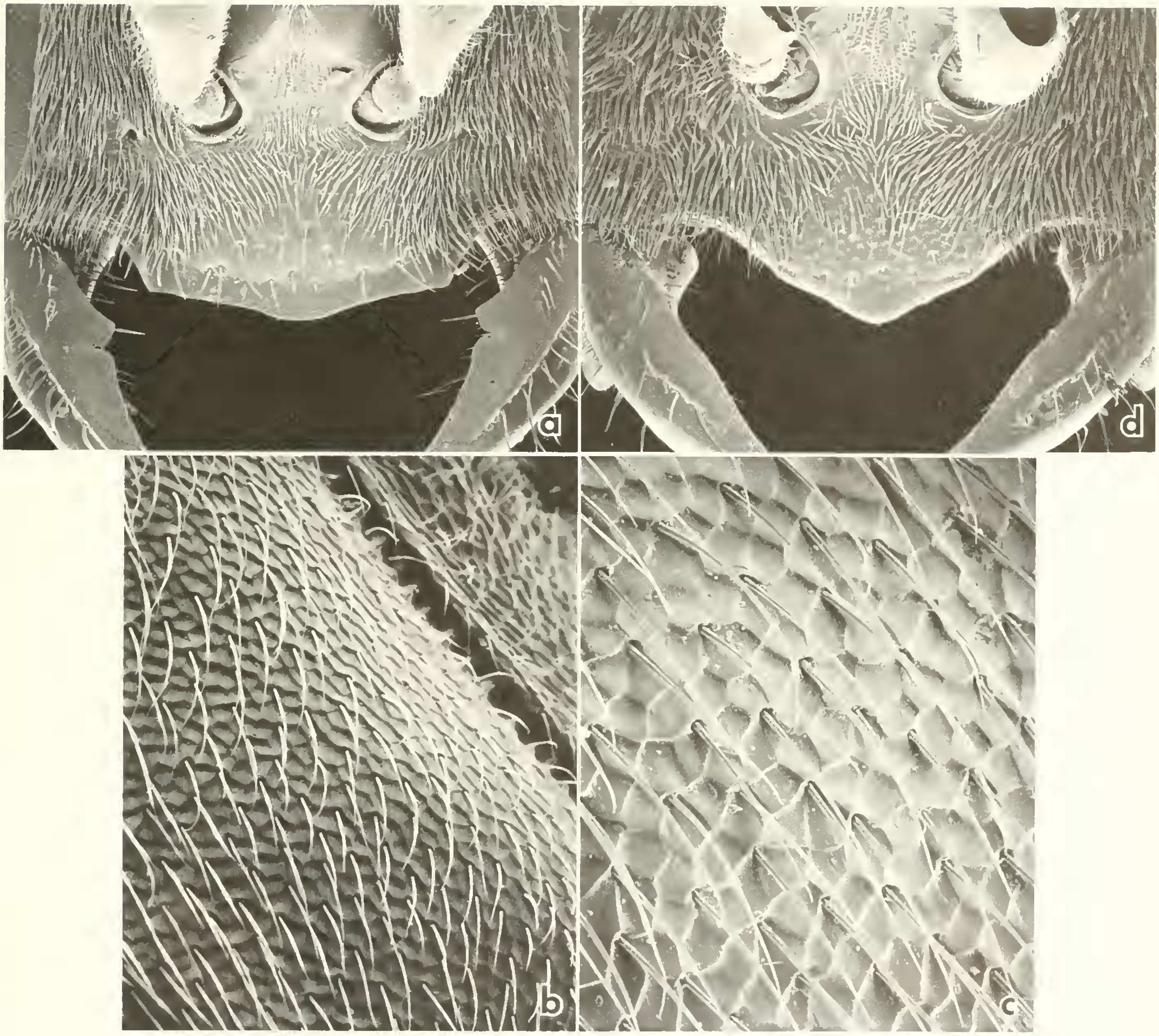

FIGURE 57. *Tachysphex tahoe* sp. n.: a—female clypeus; b—sculpture of female mesopleuron; c—same, different angle, d—male clypeus.

tex. Mesopleuron dull, irregularly microsculptured, its punctures ill defined, shallow, subcontiguous (Fig. 57b, c). Propodeal dorsum and side microareolate, side of most specimens microridged when seen from certain angles; hindface finely ridged. Discal micropunctures of tergum II varying from one or two to about three or four diameters apart. Sternum I with shallow apical depression. Hindcoxa not carinate.

Vestiture totally obscuring integument between antennal socket and orbit. Setae erect, about 1.0 MOD long, on vertex (appressed in some males); midscutal setae oriented posterolaterad or (some females) transversely; suberect on hypoepimeral area; subappressed beneath mesopleural scrobe; oriented anterolaterad on propodeal dorsum except oriented posterad basally; appressed or nearly so on midfemoral venter.

Head and thorax black, gaster red or (some males) segments IV–VII brown. Legs black, tarsal apex reddish. Terga I–IV silvery fasciate apically (weakly so in female), not fasciate in single female from Aguanga area, California. Wings hyaline. Frontal vestiture silvery.

♀.—Clypeus (Fig. 57a): middle section almost flat; bevel longer than basomedian area; lip scarcely sinuate, obtusely angulate mesally, not incised laterally; free margin shallower between lip and orbit than in *antennatus* or *tarsatus* (Fig. 57a). Dorsal length of flagellomere I 1.8–2.6 × apical width. Vertex width 0.9–1.1 × length. Tergum V with a few, sparse punctures, apical depression impunctate. Punctures of mid- and hindtrochanteral venter minute, several diameters apart. Length 6.5–8.0 mm.

♂.—Inner mandibular margin not dentate (Fig. 57d). Clypeus (Fig. 57d): bevel much shorter than basomedian area; free margin not angulate to moderately angulate between lobe and lateral section; lip obtusely triangular, of varying width (see Variation below). Dorsal length of flagellomere I 1.5–2.0 × apical width.

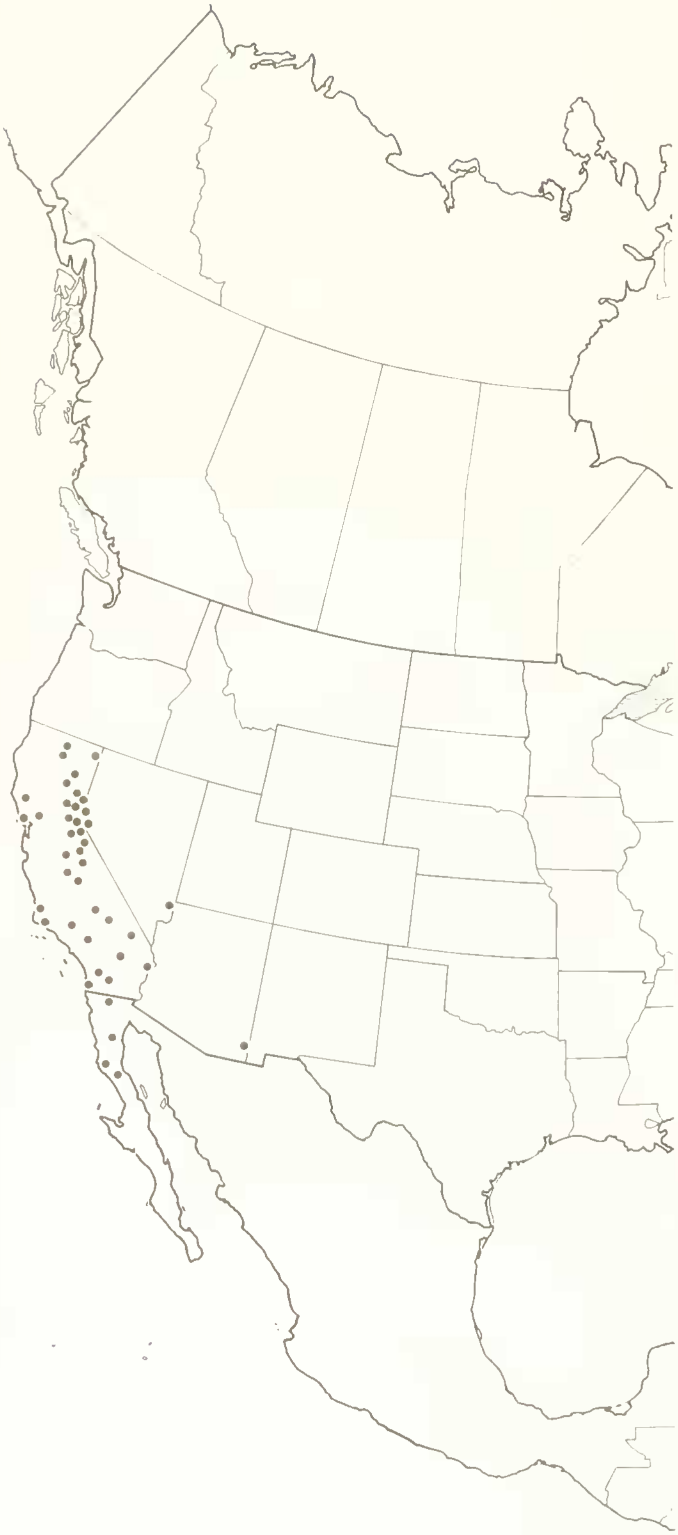

FIGURE 58. Geographic distribution of *Tachysphex tahoe* sp. n.

Vertex width 1.1–1.4 × length. Sternal punctures finer than those of mesothoracic venter. Forefemoral notch shiny, glabrous. Forebasitarsus usually without preapical rake spines, occasionally with one such spine; outer apical spine of foretarsomere II shorter than foretarsomere III. Length 5–8 mm.

Sterna II–VI velvety pubescent (except on apical depressions).

VARIATION.—Distance between clypeal lip corners in most males less than distance between corner and orbit and equal to 0.9–1.0 clypeal length. In coastal individuals (San Luis Obispo and San Diego counties of California), distance between lip corners is more than distance between corner and orbit, and equal to 1.2 of clypeal length. Vertex setae in most specimens erect, about 1.0 MOD long, but appressed in coastal males.

LIFE HISTORY.—Several females and males from Boca, California have been collected on flowers of *Eriogonum*. A female from Frazier Mountain area, California, was collected on flowers of *Baeria chrysostoma* F. and M.

GEOGRAPHIC DISTRIBUTION (Fig. 58).—California, Nevada, southeastern Arizona, and Baja California (Norte), mainly montane areas.

COLLECTING PERIOD.—17–19 March (central Baja California), 18 April to 16 September (United States).

MATERIAL EXAMINED.—Holotype: ♂, California, Placer Co., Carnelian Bay on Lake Tahoe, 4 July 1958, RMB (UCD).

Paratypes (88♀, 84♂, specimens for which depository is not indicated are all in UCD): UNITED STATES: ARIZONA: **Cochise:** Portal, WJP (5♂, CAS). CALIFORNIA: **Alpine:** Fredericksburg, WWM (1♀); Indian Creek Lake, GEB (1♀, USU). **El Dorado:** Icehouse Road (24 air mi ENE Placerville), WJP (1♀, CAS). **Fresno:** Auberry, J. A. Halstead (1♀, CAS), 12 mi SE Shaver Lake, J. A. Halstead (2♂, CAS). **Inyo:** Argus Mts., C. D. Michener (1♀, KU); Big Pine, RMB (1♀); 9 mi W Lone Pine, RMB (1♀); Lone Pine Creek, TLG (1♀, TLG). **Kern:** Short Canyon, R. O. Schuster (1♀, UCD). **Lake:** Hopland Grade, S. M. Fidel (1♀). **Lassen:** Hallelujah Junction, RMB, J. Slansky (2♀, 1♂), Summit Camp, EGL (3♀). **Los Angeles:** Crystal Lake, HEE (1♀, UCD), 2.5 mi S Pearblossom, R. W. Brooks (1♀, UCD). **Marin:** Alpine Lake, J. M. Burns (1♀, CIS). **Modoc:** Cedar Pass Campground, PHA (2♀, CAS). **Mono:** 11 mi N Bridgeport, PMM (1♀); Paradise Camp, ASM (2♀, 2♂; 1♀, WJP), Sweetwater Mts., S Fork Cottonwood Creek, HKC (1♀). **Napa:** 5.5 km NW Moscowite Corner (Capell Creek), PHA (1♀, CAS). **Nevada:** Boca, RMB, EEG, MEI, PMM, WJP, EIS, FAS (3♀, CAS, 19♀, 13♂; 3♀, 2♂, USNM, 2♀, 4♂, WJP); Prosser Dam, D. R. Miller (1♀); Sagehen Creek near Hobart Mills, MEI, FDP (1♀, 2♂). **Placer:** Carnelian Bay on Lake Tahoe, RMB (1♀, 1♂), Emigrant Gap (27 air mi W Truckee), WJP (4♀, 15♂, CAS), 4 air mi S Soda Springs, WJP (2♂, CAS), 7 mi SE Truckee, RMB (1♀). **Plumas:** 6 mi E Chester, G. Schaefers (1♀); Little Long Valley Creek (6 mi E Spring Garden), MSW (1♀, CSDA). **San Bernardino:** 2 mi W Cajon Pass, EIS (1♂); Holcomb Valley, KWC (1♀, CAS), Granite Mts., TLG (1♂, TLG), Indian Cove in Joshua Tree National Monument, KWC (2♀, 1♂, CAS), K. V. Krombein (1♀, 2♂, USNM), Vidal Junction, EGL (1♀), Willow Wash, TLG (1♂, CAS). **San Diego:** 11 mi W Aguanga, EIS (1♀, UCD); Anza Borrego Desert State Park (Plum Canyon at Yaqui Flat), K. V. Krombein (1♂, USNM); Borrego, PDH (1♀), Sorrento Beach, JAP (1♂, CIS). **San Luis Obispo:** Dune Lakes (3 mi S Oceano), J. Doyen, P. Rude (1♂, CIS), JAP (1♂, CIS). **Santa Barbara:** Santa Ynez Mts., FDP (1♂). **Sierra:** Sardine Lakes, no collector (1♀); Sierraville, RMB (1♀, CAS, 1♀, 1♂). **Siskiyou:** 1 mi SW McCloud, WJP (1♀, CAS), 27 road mi NE Weed, WJP (1♀, CAS). **Tulare:** Ash Mt. near Kaweah Power Station, D. J. Burdick (1♀, CAS). **Tuolumne:** Poopanaut Valley, Yosemite National Park, MEI (1♂, UCR). **Ventura:** Chuchupate Ranger Station (base of Frazier Mt.), PDH (1♀, CIS), Hungry Valley (5 mi S Gorman), PDH, C. W. O'Brien, G. I. Stage (2♀, 3♂, CAS, 5♀, 6♂, CIS). NEVADA: **Clark:** Juanita Spring Ranch (S Riverside), FDP and J. H. Parker (1♀, USU). **Douglas:** Spooners Lake, J. Slansky (1♂, CSDA). **Lyon:** 7 mi NE Wellington, MSW and J. S. Wasbauer (1♀, 1♂, CSDA). **Washoe:** Mt. Rose, RMB (2♂); Verdi, RMB, FDP (1♀, 2♂), MEI (1♂, UCR).

MEXICO: **Baja California Norte:** 1 mi S El Condor, JWB and DKF (1♂, SDNH); El Portezuelo (39 road mi S Cataviña), WJP (3♂, CAS), 21 mi ESE El Rosario, WJP (1♂, CAS), Vallecitos area (Sierra San Pedro Mártir), JWB and DKF (1♀, SDNH), 29°22'N, 114°20'W, WJP (1♂, CAS).

Tachysphex musciventris Pulawski

(Figures 59, 60)

Tachysphex musciventris Pulawski, 1982:33, ♀, ♂. ! Holotype: ♀, California: San Diego Co.: Borrego (UCD).

DIAGNOSIS.—The female of *musciventris* has a mesally sunken, densely pilose mesothoracic venter (Fig. 59b), unknown in

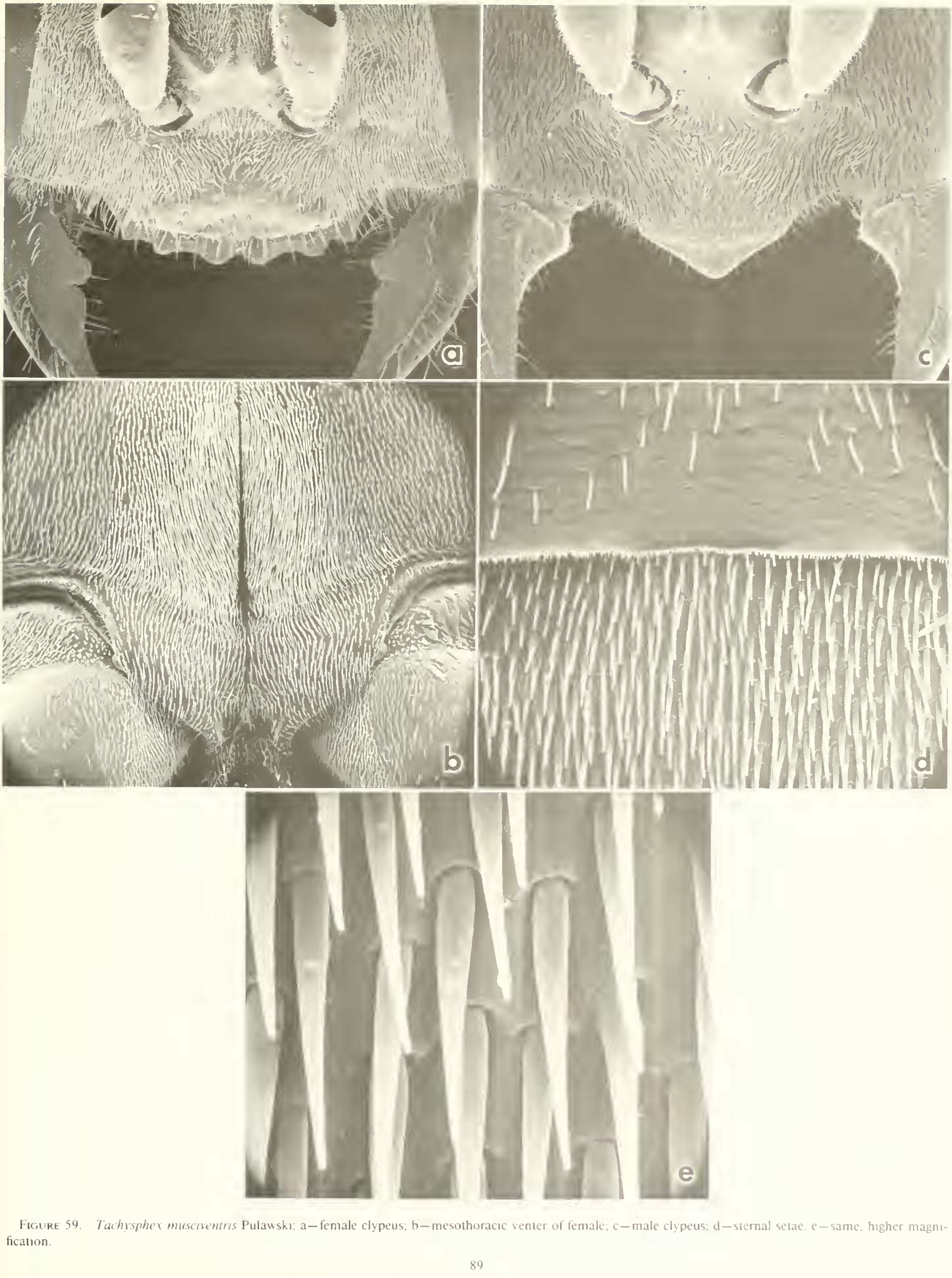

FIGURE 59. *Tachysphex musciventris* Pulawski: a—female clypeus; b—mesothoracic venter of female; c—male clypeus; d—sternal setae. e—same, higher magnification.

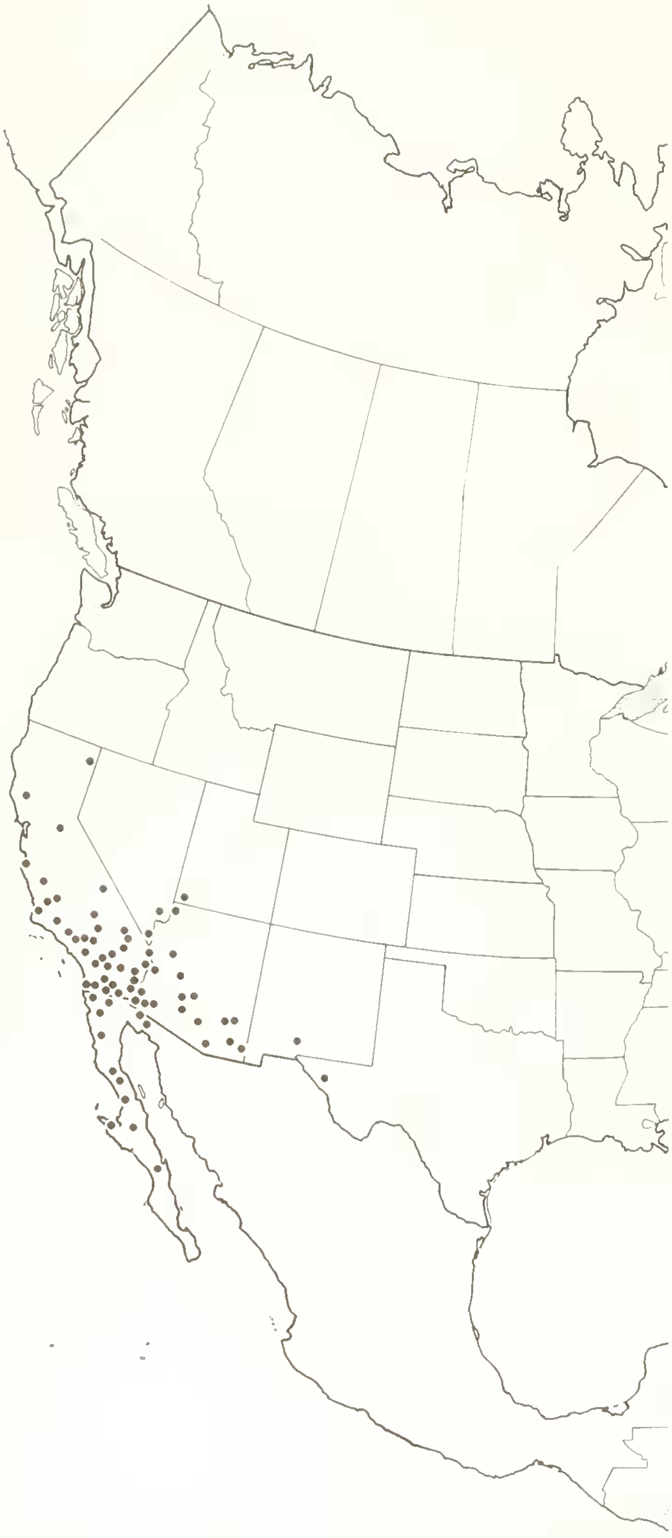

FIGURE 60. Geographic distribution of *Tachysphex musciventris* Pulawski.

any other *Tachysphex*. Most specimens also have an undulate clypeal lip (Fig. 59a) and red hindlegs.

Males of *musciventris* and *tahoe* have a triangular clypeal lip (Fig. 57d, 59c), ill-defined mesopleural pnctures, and velvety pubescent sterna III–VI (integument all or largely concealed). Unlike *tahoe*, the vertex width in *musciventris* is 1.3–2.0× length (1.1–1.4 in *tahoe*), the hypoepimeral setae are appressed, and sternum II is velvety pubescent.

DESCRIPTION.—Frontal and scutal punctures nearly contiguous (a few punctures of scutal disk more than one diameter apart in some females). Vertex punctures even, less than one diameter apart, subcontiguous in many specimens. Mesopleuron dull, its punctures ill defined, shallow, contiguous or nearly so. Propodeal dorsum uniformly microareolate; side and hindface dull, strongly microsculptured, ridged (ridges evanescent in some specimens). Micropunctures of tergum II one to two diameters apart.

Setae appressed on mesothorax and femora; oriented posterolaterad on scutum at middle.

Head and thorax black. Terga I–V silvery fasciate apically (only laterally on female tergum V). Frontal vestiture silvery. Wings almost hyaline.

♀.—Clypeus (Fig. 59a): bevel equal to basomedian area or longer; lip in most specimens emarginate mesally, with one lateral incision on each side and with three pairs of obtuse projections, but in some individuals not emarginate and with admedian pair of projections only. Dorsal length of flagellomere I 2.2–2.8× apical width. Vertex width more than length. Mesothoracic venter sunken and densely pubescent along midline on posterior (horizontal) half (Fig. 59b). Tergum V with a few, scattered punctures. Pygidial plate shiny, punctate. Trochanteral venter shiny, sparsely punctate. Forefemoral venter with minute subcontiguous punctures that are somewhat sparse basally. Length 8.5–11.5 mm.

Integument not hidden by vestiture between antennal socket and orbit. Setae appressed on vertex, dense in mesosternal depression (as seen from in front forming a conspicuous patch).

Gaster red. Femora and tibiae all black in some specimens (females from Baja California Sur, CSDA; several females from El Rosarito and Mission San Borja areas, Baja California Norte, CAS; one from Monterey, California, UCD). In most specimens, fore- and midfemur black; foretibia red on inner face; midtibia black or red ventrally; hindfemur and hindtibia red. Tarsi red.

♂.—Mandibular inner margin not dentate (Fig. 59c). Clypeus (Fig. 59c): bevel equal to basomedian area or shorter; free margin not angulate between lobe and lateral section; lip roundly triangular, its corners obtuse, closer to each other than to orbits. Dorsal length of flagellomere I 1.3–1.7× apical width. Vertex width 1.3–2.0× length. Tergum VII in most specimens sparsely punctate basomedially. Sterna evenly, minutely punctate (punctures less than one diameter apart) except for narrow, apical stripe on sterna II–VI which is smooth, glabrous (Fig. 59d, e). Forefemoral notch pubescent. Foretarsus with rake or (some small individuals) foretarsomere with apical spine only; outer apical spine of foretarsomere II longer than tarsomere width, in most specimens longer than tarsomere III. Length 5.2–9.0 mm.

Vestiture partly obscuring sculpture between antennal socket and orbit. Vertex setae subappressed, sometimes erect (about 0.6 MOD long) on postocellar impression. Sternal pubescence velvety (Fig. 59d).

Gaster red or terga VI and VII and all sterna darkened. Legs black, tarsal apex reddish, sometimes also inner face of hindtibia.

Life History.—A single female from Mesa area, Arizona (UIM), was collected on flowers on *Baileya multiradiata* Harv. and Gray, and many males from Hungry Valley, California, were collected on flowers of *Euphorbia albomarginata* T. and G.

Geographic Distribution (Fig. 60).—California to southwestern Texas, north to southwestern Utah, south to northwestern Mexico (including Baja California).

Material Examined.—252♀, 258♂.

Records.—UNITED STATES: ARIZONA **Cochise:** Dragoon Mts., Portal, 3 mi E Willcox. **Gila:** Globe. **Graham:** Roper Lake State Park. **Maricopa:** 8 mi S Buckeye, Gila Bend (also 18 mi S), 5 mi N Mesa, Rainbow Valley. **Mohave:** 8 mi E Mesquite (in Nevada), 16 mi N Wikieup. **Pima:** Silver Bell. **Pinal:** W Stanfield. **Santa Cruz:** 12 mi SW Patagonia, Tubac. **Yavapai:** 18 mi N Aguila. **Yuma:** Dateland, Ligurta, Parker, 15 and 22 mi N Yuma. CALIFORNIA. **Amador:** 5 mi E Jackson. **Fresno:** 10 mi W Coalinga **Imperial:** Chocolate Mts. (Ogilby Road 3 mi S junction Hwy. 78), Fish Creek Mts., Glamis (also 3 mi N), Ocotillo, Palo Verde (also 3 and 8 mi S). **Inyo:** Wildrose Canyon. **Kern:** 14 mi N Blackwells Corner, Iron Canyon (El Paso Mts.), 19 mi W Shafter. **Lake:** Lucerne. **Lassen:** Bridge Creek Camp, Summit Camp (E Lassen Peak). **Los Angeles:** 1 mi S Acton, Littlerock, 2 mi S Pearblossom (also 12 mi NE), 2 mi NW Valyermo **Modoc:** Cedar Pass. **Monterey:** Monterey, Seaside. **Riverside:** Anza, Boyd Desert Research Center (4 mi S Palm Desert), 18 mi W Blythe, 10 mi NW Cottonwood (Joshua Tree National Monument), Deep Canyon (3.5 mi S Palm Desert), 5 mi S Hemet, Highway 74 at Strawberry Creek, Indio, Keen Camp in San Jacinto Mts., Millard Canyon, 7 mi W North Palm Springs, Palm Canyon, Palm Desert, Palm Springs, Pinon Flat in San Jacinto Mts., Riverside (also 4 mi S), Shavers Summit, Strawberry Canyon, Thousand Palms, 10 mi E White Water. **San Bernardino:** 13 mi E Amboy, Baker (also 4 mi S), 3 mi W Barstow, 2 mi W Cajon Pass, Colton, 5 mi SE Hesperia, sand dunes 7 mi SW Kelso, Needles (also 11 mi N), 2 mi W Phelan, Red Mountain, 10 mi E Timico Acres, Vidal Junction. **San Diego:** Alpine, Borrego Valley, Boulevard–Manzanita, Coronado, Coyote Creek (Borrego Valley), 5 mi E Jacumba, Scissors Crossing. **San Luis Obispo:** 5 mi W Nipomo, 10 mi W Simmler. **Ventura:** Hungry Valley (5 mi S Gorman), Quatal Canyon (NW corner of county). NEVADA **Clark:** 20 mi W Glendale, 5 mi N Searchlight. NEW MEXICO **Dona Ana:** 4 and 11 mi N Las Cruces, Mesilla. TEXAS. **Hudspeth:** Sierra Blanca. UTAH: **Washington:** Santa Clara

MEXICO. **Baja California Norte:** Cataviña (also 27 mi SE), 4 mi S El Cóndor, 4 mi NE El Rosarito (28°42′N, 113°58′W), 7 mi S Guadalupe, 25 km SE Laguna Chapala, 3 mi NE Mission San Borja, 6 mi E Ojos Negros, San Quintin, 6 mi NE Santa Rosalillita (28°45′N, 114°10′W), 1 mi E Santa Inés near Cataviña. **Baja California Sur:** 12 mi S Guillermo Prieto, 13 air km WNW La Purisima, 3.5 km WNW San Isidro, 5.8 mi S San Juanico, E edge of Sierra Placeres (27°35′N, 114°30′W). **Sonora:** 60 mi E San Luis, 23 km SW Sonoita

Tachysphex occidentalis Pulawski

(Figures 61, 62)

Tachyspex occidentalis Pulawski, 1982:34, ♀, ♂. Holotype: ♂, California: Inyo Co.: 12 mi E Lone Pine (UCD).—Elliott and Kurczewski 1985: 293

Diagnosis.—The female of *occidentalis* has a red hindfemur and hindtibia (all or partly), and the clypeal lip is evenly arcuate, not incised laterally (Fig. 61a). This combination is also found in *solaris*, most *apricus*, and rare individuals of other species. However, in *occidentalis* the humeral plate of the forewing base is partly dark, the mesopleuron is impunctate, the mesopleural vestiture does not conceal mesopleuron, and setae of the propodeal dorsum are oriented anterolaterad between the base and apex (in *solaris*, the humeral plate is uniformly ferrugineous, the mesopleuron is minutely punctate, the mesopleural vestiture largely conceals the integument, and most setae of the propodeal dorsum are oriented transversely; in *apricus*, the lateral setae are oriented posterad and join apicomesally). The following characters help separate *occidentalis* from occasional specimens of other species that have partly red legs and an entire clypeal lip. The scutal setae are oriented posterad, and sternum I is not depressed apically (in *texanus* and its relatives, the midscutal setae are oriented laterad, Fig. 90b and c, and sternum I has an apical depression, Fig. 91c and d). The clypeal lobe is relatively narrow, the distance between the lip corners being 1.5 × clypeal length or less (the clypeal lobe is broad in *antennatus* and *crassiformis*, and the distance between the clypeal lip corners is 1.7–2.5 × clypeal length). The axilla is evenly convex (axilla steplike or expanded in most *crassiformis*). The mesopleuron is finely sculptured (mesopleuron coarsely punctate to rugose in *irregularis*). Finally, the vertex setae are appressed posteriorly, and tergum II is fasciate apically (in *mirandus*, vertex setae are erect, and tergum II is asetose except laterally).

The male of *occidentalis* has an unusually narrow clypeal lobe (distance between lip corners about 0.6 of distance between lip and orbit), with the lip rounded laterally (Fig. 61b). In addition, the mandibular inner margin is not dentate or at most with a rudimentary tooth. The clypeus is equally narrow in *eldoradensis* and *hopi*, but the lip is angulate, and the mandibular inner margin has a well-defined tooth. Subsidiary recognition features of the male of *occidentalis* are: sternal punctures (Fig. 61c) about as large as those on the mesothoracic venter (markedly larger in some specimens); and the hypostomal carina expanded, broader than in most other species (but narrower than in most *lamellatus*).

Description.—Punctures subcontiguous on frons, scutum, mesothoracic venter, and trochanters. Vertex punctures no more than one diameter apart or (some specimens) a few interspaces larger than punctures. Mesopleuron dull, irregularly microsculptured, its punctures ill defined (especially in female). Propodeal dorsum and side microareolate, side microridged when seen from certain angles; hindface finely ridged. Discal micropunctures of tergum II one to two diameters apart. Sternum I with shallow apical depression. Hindcoxa not carinate.

Vestiture totally obscuring sculpture between antennal socket and orbit. Setae suberect on vertex (appressed posteriorly in female), about 1.0 MOD long; subappressed on scutal disk, oriented almost uniformly posterad; suberect on hypoepimeral area; appressed below mesopleural scrobe; appressed (female) or suberect, about 0.5 MOD long (male) on midfemoral venter apically. Setae of propodeal dorsum inclined obliquely anterad mesally, directed laterad laterally (lateral zone as wide as median zone or wider).

Head and thorax black; terga I–IV silvery fasciate apically, tergum V with rudimentary fascia. Wings hyaline. Frontal vestiture silvery.

♀.—Clypeus (Fig. 61a): middle section almost flat; bevel about as long as basomedian area; lip evenly arcuate, at most scarcely incised laterally; free margin shallower between lobe and orbit than in *antennatus* or *tarsatus*. Dorsal length of flagellomere I 2.0–2.6 × apical width. Vertex width 1.0–1.2 × length. Tergum V densely punctate or (some specimens) sparsely punctate mesally. Forecoxa with short, apicomedian process. Tarsomeres IV and V of most specimens slenderer than average in the *pompiliformis* group; hindtarsomere IV emarginate on about 0.65–0.75 of its length. Length 7–10 mm.

Gaster red or terga IV and V partly black. Fore- and midfemora black; fore- and midtibiae black or red; hindfemur red or largely black; hindtibia red or partly black; tarsi red or reddish.

♂.—Mandibular inner margin not dentate (Fig. 61b) or with evanescent tooth. Clypeus (Fig. 61b): bevel much shorter than basomedian area; free margin not angulate between lobe and

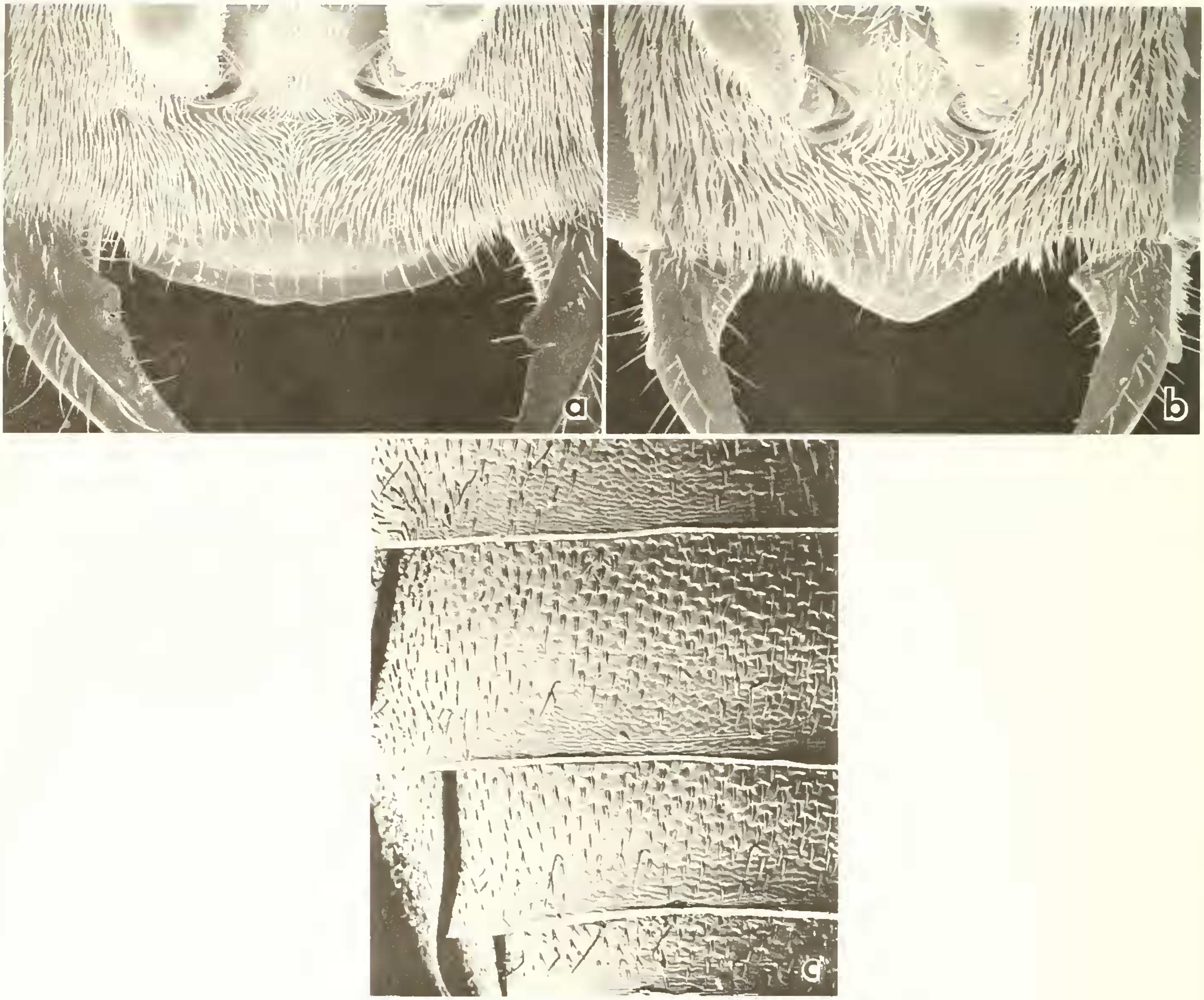

FIGURE 61. *Tachysphex occidentalis* Pulawski. a—female clypeus; b—male clypeus; c—male sterna.

lateral section; lobe arcuate, distance between its corners about 0.6–0.8 of distance between lobe and orbit. Dorsal length of flagellomere I 1.3–1.7 × apical width. Vertex width 1.3–1.4 × length. Sternal punctures as large as those on mesothoracic venter or larger, apical depression impunctate (Fig. 61c). Forefemoral notch shiny, glabrous. Forebasitarsus with none to four preapical rake spines; outer apical spine of foretarsomere II as long as foretarsomere III. Length 6–7 mm.

Gastral segments I–III or only terga I and II red, remainder black. Legs black, tibiae brown in some specimens; tarsal apex reddish.

LIFE HISTORY.—Elliott and Kurczewski (1985) report a nymph of the acridid *Schistocerca shoshone* (Thomas) as prey of *occidentalis*. A female from Wadsworth, Nevada (UCD), is pinned with two immature *Melanoplus*, probably *cinereus* Scudder (Acrididae), determined by D. C. F. Rentz.

GEOGRAPHIC DISTRIBUTION (Fig. 62).—Xeric areas west of the Rocky Mountains, north to Oregon and Idaho, south to New Mexico and Baja California (Norte).

MATERIAL EXAMINED.—116♀, 203♂ (ASU, CAS, CIS, CSDA, KWC, LACM, NYSU, OSDA, SDNH, UCD, UCR, UIM, USNM, USU).

RECORDS.—UNITED STATES: ARIZONA: **Apache:** Lukachukai. **Cochise:** 3 mi E Willcox. **Coconino:** 4.5 mi E Moenkopi. **Mohave:** Littlefield, 8 mi NE Mesquite (in Nevada). **Navajo:** Jadito Trade Post. CALIFORNIA: **Fresno:** Jacalitos Canyon. **Inyo:** Antelope Springs (15 mi S Big Pine), Deep Springs, Lone Pine (also 2 mi S, 3 mi N, 7.3 mi W, 12 mi NE), Owens Valley (sand dunes E Tinemaha), Saline Valley (NW end). **Kern:** 12 mi E Mojave, 14 mi W Shafter. **Lassen:** Hallelujah Junction. **Los Angeles:** 1 mi W Littlerock, 12 mi NE Pearblossom. **Mono:** 9 mi N Bishop, Chalfont, 7 mi SW Lee Vining, Mono Lake dunes. **Monterey:** Arroyo Seco Camp. **Plumas:** Chilcoot. **Riverside:** Anza. **San Bernardino:** Cronise Valley, Cronise Wash (15 mi E Baker), Four Corners, Kramer Hills, Twentynine Palms, Yermo. **San Diego:** Borrego Valley, Scissors Crossing. **San Luis Obispo:** 10 mi W Simmler. **Ventura:** Hungry Valley (5 mi S Gorman). IDAHO: **Cassia:** 2.5 mi S Malta. **Franklin:** Preston. **Fremont:** 6 mi NW St. Anthony, St. Anthony Sand Dunes. **Lincoln:** 4.5 mi E Dietrich, Shoshone. **Oneida:** 5 mi S Holbrook. NEVADA: **Churchill:** 12 mi NE Stillwater. **Clark:** Glendale. **Humboldt:** Orovada, Winnemucca (also 10 mi N). **Lyon:** Fernley, Yerington. **Mineral:** Huntoon Valley sand dunes, Teels Marsh sand dunes. **Washoe:** Nixon, Patrick, 15 mi E Reno, Wadsworth (also 2.8 mi W). NEW MEXICO: **Dona Ana:** Mesilla. OREGON: **Harney:** 21.5 mi NW Fields sand dunes. UTAH. **Cache:** Logan (Dry Canyon). **Duchesne:** 5.5 mi W Roosevelt. **Emery:** Goblin Valley, N Goblin Valley (Buckskin Spring, Wild Horse Creek), NE Goblin Valley (4 air mi N Gilson Butte, 2 and 3.2 mi E Little Gilson Butte), San Rafael Desert (2.5 mi SW Iron Wash, 3 mi SSE Temple Mt., Woman Wash). **Grand:** Bartlett Flat (N Dead Horse Point). **Kane:** Coral Pink Sand Dunes. **Millard:** 6 and 15 mi N Delta, 12 mi NW Fillmore. **San Juan:** 25 mi S Moab. **Washington:** 11 mi N Saint George, Santa Clara. WYOMING: **Sweetwater:** 20 mi W Farson.

MEXICO: **Baja California Norte:** 4 mi NE El Rosarito (28°42′N, 113°58′W), Punta de Cabras (12 mi W Santo Tomás), San Quintin, 5 mi S Santa Maria, 1–3 mi SE Santa Rosalillita (28°44′N, 114°08′W).

Tachysphex solaris Pulawski

(Figures 63, 64)

Tachysphex solaris Pulawski, 1982:35, ♀, ♂. Holotype: ♀, California: San Diego Co.: Borrego Valley (UCD).

DIAGNOSIS.—*Tachysphex solaris* can be recognized by the color of the basal plates in the forewing: the humeral plate is uniformly yellowish (with a dark, median spot in some individuals), thus contrasting with the dark median plate. In other species the humeral plate is either all dark or yellowish anteriorly and dark posteriorly, thus not contrasting in color with the median plate or (some *ashmeadii*) contrasting only slightly. Subsidiary diagnostic features of *solaris* are: size small (body length 5.0–7.5 mm); clypeal free margin shallowly concave between lobe and orbit (Fig. 63a, b); mesopleural vestiture largely concealing integument; setae of propodeal dorsum oriented mainly transversely.

DESCRIPTION.—Clypeal free margin shallowly concave between lobe and orbit; bevel usually shorter than basomedian area but equal in some females; lip evenly arcuate, not emarginate mesally or incised laterally (Fig. 63a, b). Punctures fine, subcontiguous on frons, vertex, and mesopleuron; up to one or two diameters apart on scutum and mesothoracic venter; minute, sparse on mid- and hindtrochanteral venter. Propodeal dorsum microareolate, side microsculptured, hindface ridged. Discal micropunctures of tergum II about one diameter apart. Hindcoxa not carinate.

Vestiture totally concealing integument between antennal socket and orbit, largely so on mesopleuron and, in female, on fore- and midfemoral venter; setae appressed on vertex, scutum, femora, and beneath mesopleural scrobe, inclined on hypoepimeral area; midscutal setae oriented posterolaterad (transversely in some males); most setae oriented transversely on propodeal dorsum.

Head and thorax black, clypeal bevel yellowish brown in some specimens; mandible largely yellowish. Gastral terga I–IV silvery fasciate apically. Wings hyaline, humeral plate of forewing base uniformly yellowish in most specimens, but with dark spot in the single male from Glendale, Nevada (USU). Frontal pilosity silvery.

♀.—Clypeus (Fig. 63a): distance between lip corners 1.9–2.0 × length. Dorsal length of flagellomere I 2.2–2.5 × apical width. Vertex width mostly less than length, but more than length in some specimens. Length 5–7 mm.

Gaster red. Forefemur black, midfemur black or red, hindfemur red or basally black; tibiae red or fore- and midtibiae nearly all black; tarsi red.

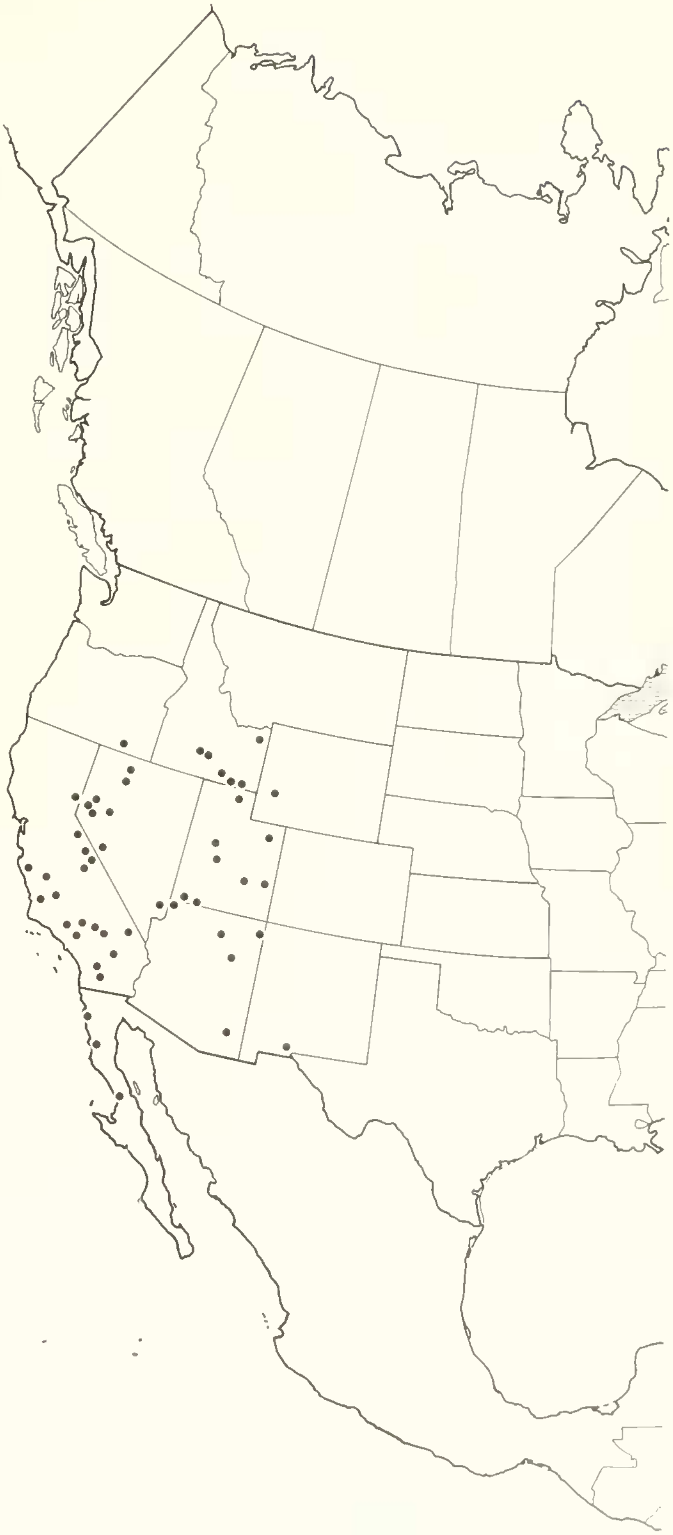

FIGURE 62. Geographic distribution of *Tachysphex occidentalis* Pulawski.

♂.—Mandibular inner margin with tooth. Clypeus (Fig. 63b): lip arcuate, distance between its corners about 1.6 × clypeal length; corners ill defined, closer to orbits than to each other. Dorsal length of flagellomere I 1.6–2.0 × apical width. Vertex

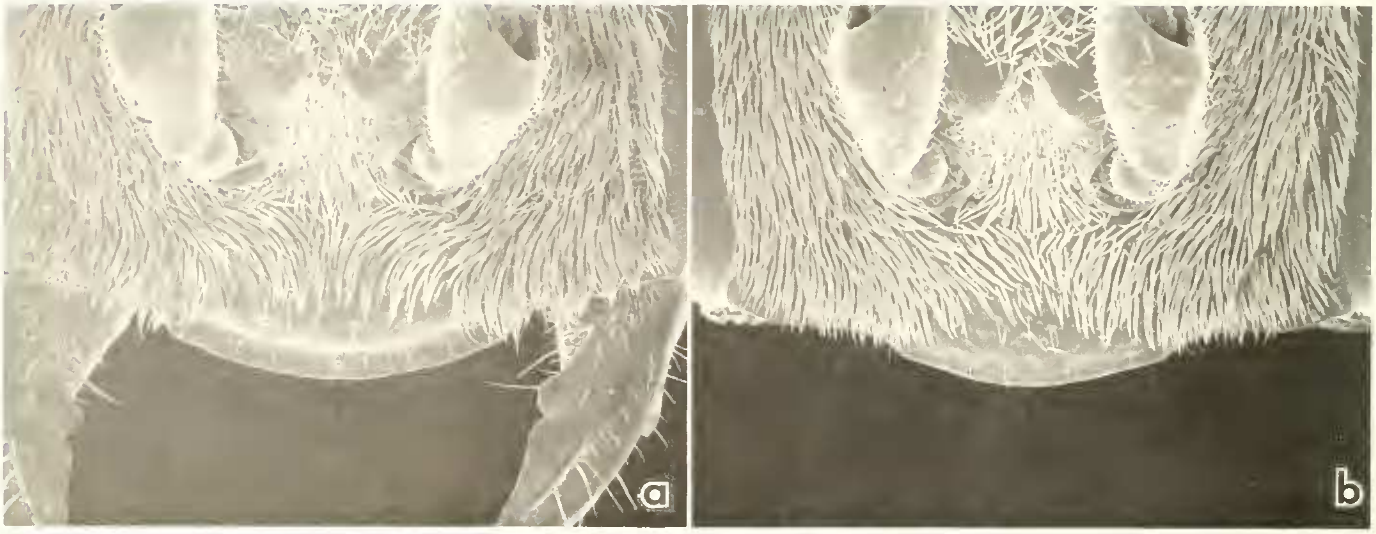

FIGURE 63. *Tachysphex solaris* Pulawski: a—female clypeus; b—male clypeus.

width 1.0–1.3 × length. Sterna with minute, dense punctures, apical depression in many specimens contrastingly impunctate. Forefemoral notch pruinose. Forebasitarsus outer margin with none to four preapical spines that are up to two basitarsal widths long; apical spine of foretarsomere II longer than foretarsomere III. Length 5–6 mm.

Sternal vestiture dense, velvety in some specimens on sterna III and IV, apical depressions glabrous.

Gastral segments I–III red, remainder black. Femora black; tibiae black or reddish brown, hindtibia red in some specimens; tarsi red.

GEOGRAPHIC DISTRIBUTION (Fig. 64).—Central and southern California, southern Nevada, western and southern Arizona (xeric areas).

MATERIAL EXAMINED.—74♀, 32♂ (ASU, CAS, CIS, CSDA, MCZ, SDNH, TLG, UAT, UCD, UCR, USNM, USU).

RECORDS.—UNITED STATES: ARIZONA: **Maricopa:** Rainbow Valley. **Mohave:** 8 mi E Mesquite (in Nevada). **Pinal:** 5 mi NW Coolidge. **Yuma:** 10 mi W Aztec, 6 and 8 mi SE Parker, 15 mi E Yuma (also 18 mi NE). CALIFORNIA: **Imperial:** Glamis, Palo Verde, Pinto Wash. **Inyo:** Ballarat, 13 mi S Death Valley Junction, Lone Pine (also 2 mi E), S end Owens Lake, 15 mi S Panamint Springs. **Riverside:** 18 mi W Blythe, Hopkins Well, Thousand Palms. **San Bernardino:** Bagdad, 16 mi SW Baker on Basin road, 23 mi S Baker on Alton road, Colton Hills, Cottonwood Wash, Cronise Valley, Kelso (also 7 mi SW), Twentynine Palms (also 10 mi E). **San Diego:** Borrego Valley. NEVADA: **Clark:** Glendale (also 20 mi W).

Tachysphex apricus Pulawski

(Figures 65, 66)

Tachysphex apricus Pulawski, 1982:29, ♀, ♂. Holotype: ♀, California: San Diego Co.: Borrego Valley (UCD).—Elliott and Kurczewski 1985:293.

DIAGNOSIS.—*Tachysphex apricus* differs from all other species of the *pompiliformis* group by the orientation of setae on its propodeal dorsum (the median setae are inclined forward, but the lateral setae are directed obliquely backward and joining apicomesally) and also by the structure of the propodeal side (integument microsculptured but shiny, with fine, sparse punctures; Fig. 65b). Both characters are also found in species of the *brullii* subgroup, but the unspecialized apical tarsomere of the female of *apricus* is distinctive. In the male of *apricus*, sterna are simple (sterna III–V with graduli or a transverse sulcus in males of the *brullii* subgroup), and most individuals (Texan specimens are exceptional) can also be recognized by the compressed femoral notch whose glabrous bottom forms an obtuse, longitudinal crest (Fig. 65e). *Tachysphex idiotrichus* has a similar crest, but unlike that species the body vestiture is short in *apricus*.

DESCRIPTION.—Mesopleuron alutaceous, its punctures subcontiguous to (some females) about two diameters apart, inconspicuous (most specimens) to well defined. Propodeal dorsum dull, microareolate; side alutaceous, shiny, with minute, shallow punctures (Fig. 65b) that are mostly evanescent in male and absent in some specimens; hindface ridged. Tergum II with evanescent microsculpture. Sternum I shallowly depressed at apex. Hindcoxa carinate basally.

Vestiture totally obscuring sculpture between antennal socket and orbit, largely so on mesopleuron. Setae erect or suberect, 0.7–1.0 MOD long on vertex; appressed or subappressed on scutum (oriented posterad at middle); appressed or suberect (and then about 1.0 MOD long) on midfemoral venter. Median setae of propodeal dorsum (most setae in most specimens) inclined anterad, but lateral setae inclined obliquely posterad.

Head and thorax black. Gaster red or terga V–VII brown in some males; terga I–IV (I–IV in some males) silvery fasciate apically. Wings hyaline. Frontal vestiture silvery.

♀.—Clypeus (Fig. 65a): bevel about as long as basomedian area; lip arcuate, without median notch or lateral incisions. Dorsal length of flagellomere I 2.3–2.5 × apical width. Frons shallowly punctate, most punctures less than one diameter apart. Vertex as wide as long or slightly wider, its punctures fine, about one diameter apart. Scutal punctures fine, one to two diameters apart, but many discal punctures often two to three diameters apart. Punctation of tergum V sparse to dense (see Geographic Variation below), apical depression impunctate. Pygidial plate (Fig. 65c) somewhat broader apically than in most species of the *pompiliformis* group. Fore- and midtrochanteral venter alutaceous, with minute, sparse punctures. Hindtarsomere IV dorsally emarginate on less than half length, insertion of hindtarsomere V close to base of emargination. Length 6.5–8.0 mm.

Legs partly red in most specimens, but all black in individuals from southern Texas and some individuals from southern Arizona (see Geographic Variation below for details).

♂.—Mandibular inner margin with small tooth (Fig. 65d). Clypeus (Fig. 65d): bevel shorter than basomedian area to nearly absent; lip arcuate, its corners obtuse, not prominent, closer to orbits than to each other. Dorsal length of flagellomere I 1.5–1.75× apical width. Frons dull, microreticulate. Vertex width 0.9–1.3× length; vertex punctures minute, about one diameter apart. Scutal punctures subcontiguous, but some discal punctures up to two diameters apart. Sterna very finely, very densely punctate and pubescent. Forefemoral notch variable (see Geographic Variation below). Foretarsus without rake; outer apical spine of foretarsomere II shorter than foretarsomere III. Length 5.5–6.0 mm.

Legs black, tarsal apex brownish.

LIFE HISTORY.—The only male examined from Hungry Valley, California (UCD) was collected on flowers of *Euphorbia albomarginata* T. and G.

As noted by Elliott and Kurczewski (1985), a female collected at Tucson, Arizona, is pinned with a phasmid, *Parabacillus hesperus* Hebard, more than four times its length. Phasmids are not known as prey of *Tachysphex*, and the record must be accepted with scepticism until new observations confirm or invalidate it.

GEOGRAPHIC VARIATION.—In most females tergum V is sparsely punctate, but it is densely punctate in a female from Sahuarita, Arizona and all 37 females studied from Kleberg County, southeastern Texas.

In most females the hindfemur, hindtibia, and hindtarsus are red, and the remaining legs are black (also hindcoxa, fore- and midtibia red in some specimens). The hindfemur is red, and the hindtibia and hindtarsus are largely red in specimens from San Luis Potosí area in Mexico (KU). The legs are all black (except tarsal apex reddish) in a female from Sahuarita, Arizona (UCD) and in the females from Kleberg County, Texas.

In most males, the distance between the clypeal lip corners is 1.1–1.2× clypeal length, but 1.3–1.4× in all 13 males examined from Kleberg County, Texas (the clypeal lobe is therefore longer).

In most males, the forefemoral notch is compressed, so that its glabrous bottom forms an obtuse, longitudinal crest (Fig. 65e). The notch's bottom is not compressed in the males from Kleberg County, Texas (CAS).

GEOGRAPHIC DISTRIBUTION (Fig. 66).—Xeric areas between southeastern Texas, southern Utah, southern Nevada south to Mexico (Baja California, Zacatecas).

MATERIAL EXAMINED.—76♀, 84♂ (ASU, CAS, CIS, CNC, CSDA, CSU, FSCA, HKT, KU, LACM, NYSU, OSU, TLG, UAT, UCD, UCR, USNM, USU).

RECORDS.—UNITED STATES: ARIZONA: **Cochise:** 6 mi N Apache, Portal. **Coconino:** 4.5 mi E Moenkopi. **Maricopa:** 10 mi E Gila Bend, 3 mi SW Wickenburg. **Mohave:** 4 mi W Chloride, 8 mi E Mesquite (in Nevada), 15 mi SE Wikieup. **Pima:** 3 mi S Ajo, Organ Pipe Cactus National Monument, Sahuarita, Santa Rita Mts., Tucson. **Pinal:** W Stanfield. **Yavapai:** Bloody Basin, 10 mi NW Congress. CALIFORNIA: **Imperial:** Glamis, Palo Verde, Pinto Flat, Pinto Wash. **Inyo:** Antelope Springs, 2 and 5 mi E Big Pine, Big Pine Creek, Eureka Valley (12 mi N, 10 mi W Sand Dunes), Little Lake, 3 mi W Lone Pine, Tuttle Creek (2 mi SW Lone Pine). **Kern:** Kernville, Mojave. **Riverside:** 18 mi W Blythe, Magnesia Canyon, 3.5 and 4 mi S Palm Desert, San Andreas Canyon, San Timoteo Canyon, Shavers Summit. **San Bernardino:** 1 mi S Adelanto, Colton Hills, Cottonwood Wash, Granite Mts., 6 mi S Kelso, sand dunes 7 mi SW Kelso, Kramer, 3 mi S Kramer Junction, Lucerne Valley, Mitchell's Caverns, Providence Mts. State Park, 36 road mi E Twentynine Palms, Wheaton Springs, Yermo. **San Diego:** Borrego Valley, Mount Palomar, Scissors Crossing. **Ventura:** Hungry Valley (5 mi S Gorman), Sespe Canyon. NEVADA: **Clark:** Jean, Juanita Spring Ranch S Riverside, 20 mi S Searchlight. NEW MEXICO: **Dona Ana:** Las Cruces. **Otero:** Alamogordo, Alamo Canyon near Alamogordo. TEXAS: **Brewster:** Big Bend National Park (Nine Point Draw). **Kleberg:** 20 mi SE Kingsville ("Site 55"), Riviera Beach. **Ward:**

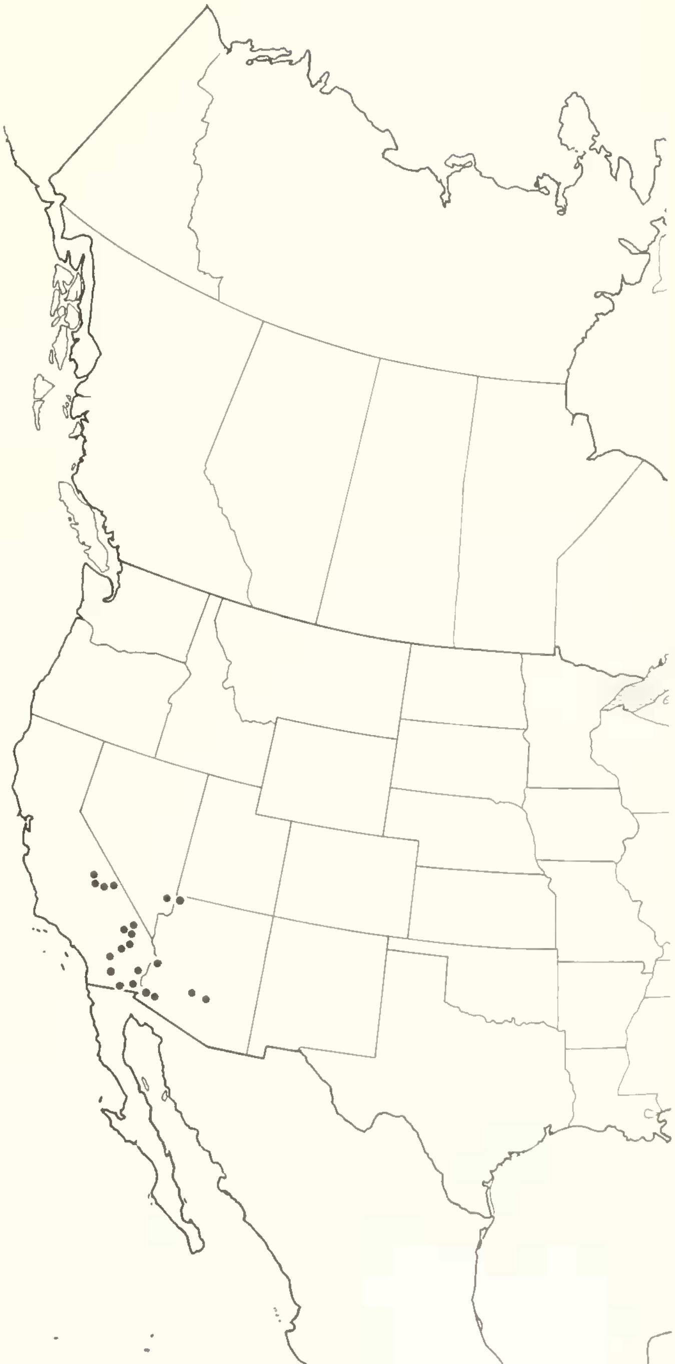

FIGURE 64 Geographic distribution of *Tachysphex solaris* Pulawski.

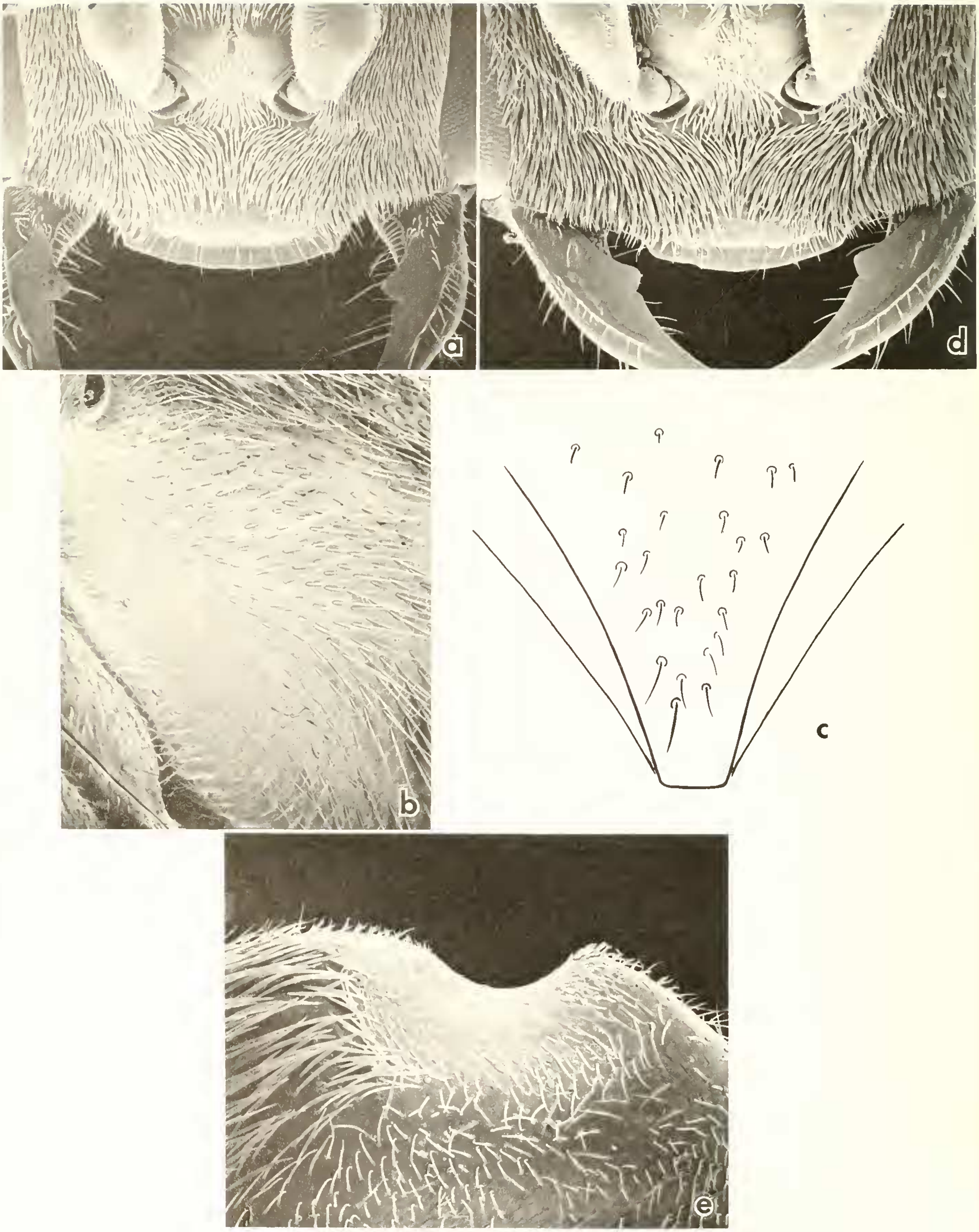

FIGURE 65. *Tachysphex apricus* Pulawski: a—female clypeus; b—propodeal side of female; c—pygidial plate of female; d—male clypeus; e—forefemoral notch of male

Monahans. UTAH: **Emery:** Buckskin Spring N Goblin Valley, 2 mi Little Gilson Butte (NE Goblin Valley). **Washington:** Gunlock, Leeds Canyon, Paradise Canyon.

MEXICO: **Baja California Norte:** San Angel 16 mi N Puertecitos. **Baja California Sur:** 35 km S Mulegé. **San Luis Potosi:** 29 mi SW San Luis Potosi. **Tamaulipas:** San Antonio (road 101 W Ciudad Victoria). **Zacatecas:** 9 mi N Ojocaliente.

Tachysphex sulcatus sp. n.

(Figures 67, 68)

Derivation of Name.—Sulcatus is a Latin masculine adjective meaning furrowed; with reference to the mandibular sulcus.

Diagnosis.—*Tachysphex sulcatus* has a dull, microsculptured mesopleuron. The shape of the clypeus and type of vestiture characterize the female: the clypeal lip is not incised laterally (Fig. 67a), the setae are appressed or nearly so on vertex, erect and 1.3 MOD long near hypostomal carina posteriorly, suberect on hypoepimeral area, and appressed below mesopleural scrobe. Several species are similar: *apricus* (which has a peculiar setal pattern on the propodeal dorsum), *miwok* (in which setae are appressed along the hypostomal carina), *occidentalis* (hindtibia all or partly red, while all black in *sulcatus*), and *tahoe* (clypeal lip weakly sinuate, while arcuate in *sulcatus*). Most females of *sulcatus* also have a longitudinal sulcus on the mandibular outer side, beyond the notch (Fig. 67c, d), but the sulcus is vestigial in some. It is vestigial or absent in other species.

In the male the clypeal lobe is rounded (free margin of lobe arcuate, not angulate laterally; Fig. 67e), as in *occidentalis* and *tipai*. In *sulcatus*, the clypeal lobe is broad (distance between lip corners about equal to distance between corner and orbit), the vertex width is about 1.1 × length, the setae are nearly erect on postocellar impression and nearly appressed on remaining vertex, the length of flagellomere II is about 2.0 × width, the mesopleural setae are appressed beneath scrobe, and sterna are finely punctate throughout. In *occidentalis*, the distance between lip corners is about 0.6–0.8 the distance between a corner and the orbit, sternal punctures are at least as large as those on the mesothoracic sternum, and the apical depressions of sterna II–V are impunctate. In *tipai*, the vertex width is about 1.4–1.6 × length, the vertex setae are erect, the length of flagellomere II is 2.25–2.5 × width, and the mesopleural setae are subappressed to suberect beneath scrobe.

Description.—Punctures less than one diameter apart on frons, vertex, scutum, and mesothoracic venter, about one diameter apart on vertex in some females. Mesopleuron dull, with ill-defined, contiguous punctures. Propodeal dorsum microareolate, side microareolate or microscopically ridged, hindface finely ridged. Sternum I without apical depression. Hindcoxa not carinate or weakly carinate basally.

Setae concealing integument between antennal socket and orbit; nearly erect on postocellar impression and nearly appressed on remaining vertex; almost uniformly oriented posterad on scutum; suberect on hypoepimeral area and appressed beneath scrobe; oriented anterolaterad on propodeal dorsum; appressed on midfemoral venter.

Head, thorax, and legs black, tarsal apex reddish. Gaster red or (one of the males studied) apical terga dark; terga I–III (I–IV in male) silvery fasciate apically. Frontal vestiture silvery. Wings almost hyaline.

♀.—Clypeus (Fig. 67a, b): bevel longer than basomedian area, with several sparse, unusually large punctures; lip arcuate, not incised laterally, mesally not marginate or with a rudimentary notch; free margin shallowly concave between lobe and orbit. Mandibular outer side sulcate beyond notch (Fig. 67c, d). Dorsal length of flagellomere I 2.2–2.4 × apical width. Vertex width

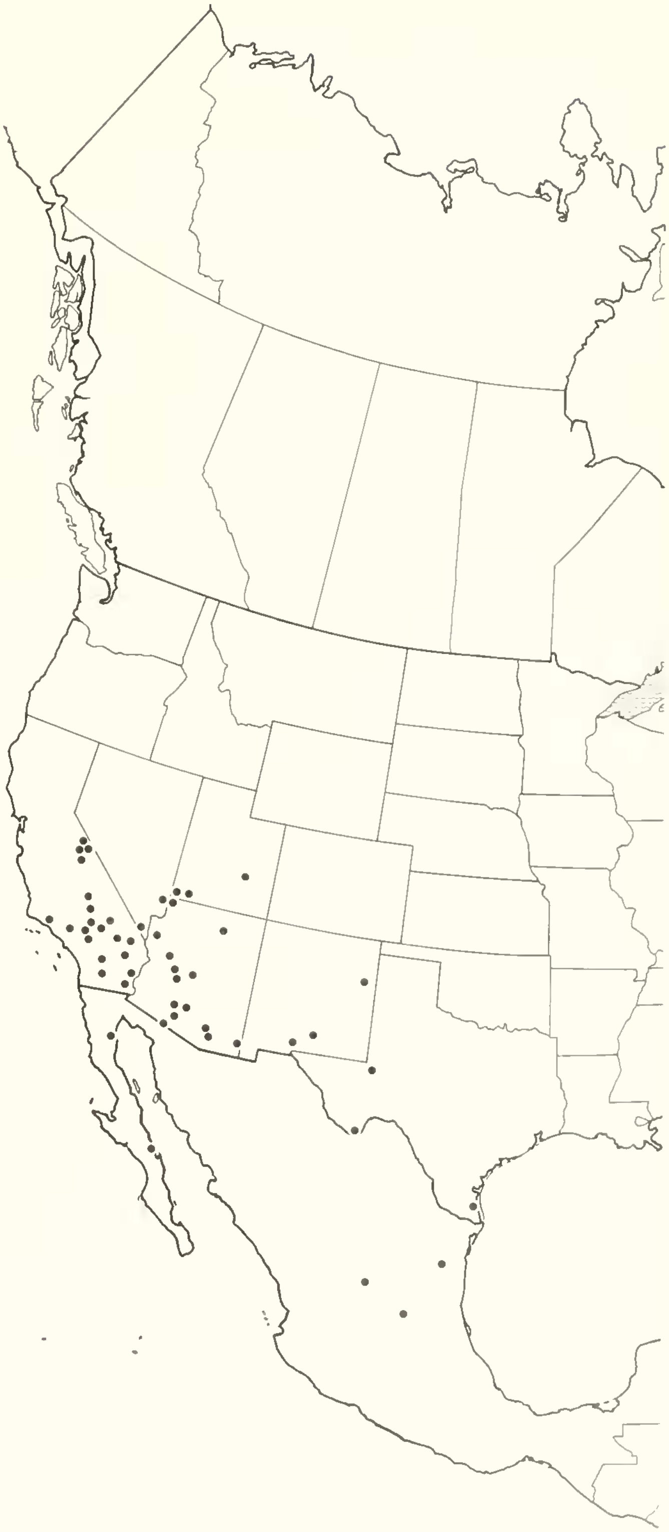

Figure 66. Geographic distribution of *Tachysphex apricus* Pulawski.

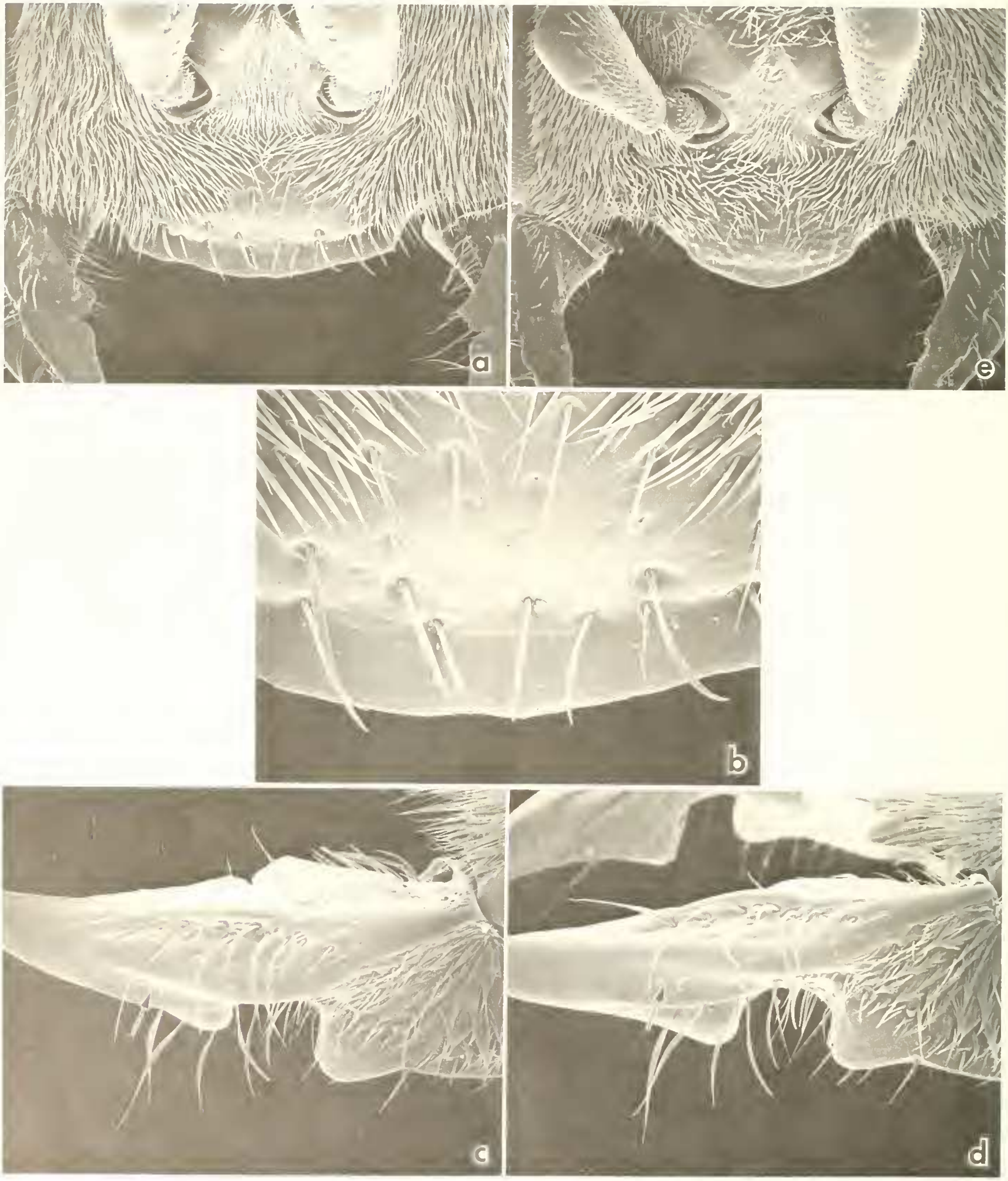

Figure 67. *Tachysphex sulcatus* sp. n. a—female clypeus, b—anteromedian portion of female clypeus, c—female mandible (arrow indicates the sulcus); d—same, different orientation, e—male clypeus.

0.9–1.1 × length. Discal micropunctures of tergum II about two to three diameters apart. Tergum V sparsely punctate mesally, apical depression impunctate. Pygidial plate alutaceous, sparsely punctate. Femora and trochanters densely uniformly punctate. Length 8–9 mm.

♂.—Mandibular inner margin not dentate (Fig. 67e). Clypeus (Fig. 67e): bevel about as long as basomedian area, with several punctures that average larger than in other species; clypeal free margin shallowly concave between lobe and orbit, not angulate between lobe and lateral section (free margin of lobe rounded); lip corner vestigial, separated by a distance that is about equal to clypeal length and also to distance that separates corner from orbit. Dorsal length of flagellomere I 1.5–1.75 apical width. Vertex width 1.1 × length. Sterna densely punctate throughout. Forefemoral notch pruinose. Forebasitarsus without preapical rake spines or (some specimens) with one subbasal spine. Outer apical spine of foretarsomere II no longer than tarsomere width. Length 6 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 68).—Northern California to Baja California Sur, adjacent areas of Nevada.

COLLECTING PERIOD.—22–23 April (Baja California), 9 June to 22 October (U.S.A.).

MATERIAL EXAMINED.—Holotype: ♀, California: Los Angeles Co.: Angeles Crest Highway, Arroyo Seco, Switzer Station, 29 July 1977, PHA (CAS, Type #15908).

Paratypes (31♀, 9♂): UNITED STATES: CALIFORNIA **Contra Costa:** Mt. Diablo, 2,000 ft, 11 July, year not indicated, FXW's handwriting (1♀, CAS). **Inyo:** Antelope Springs, 1 July 1961, J. S. Buckett (1♀, UCD). **Lassen:** Doyle, 30 Aug 1978, TRH (1♀, CSDA). **Los Angeles:** Kenter Canyon (NW Los Angeles), 29 Aug 1978, C. D. Nagano (1♀, LACM); Lake Hughes, EIS, 1 Aug 1958 (1♀, UCD), Tanbark Flat, 20 and 21 June 1956, RCB (2♀, UCD), 21 June 1956, RCB (1♂, CAS), 23 June 1956, RMB (1♀, UCD), 8 July 1950, FXW (1♀, 2♂, CAS), 10 July 1956, RMB (1♀, CAS), 14 July 1956, RMB (1♂, UCD), 18 July 1956, RMB (1♀, UCD); Vasquez Rocks in San Gabriel Mts., 17 July 1964, R. R. Snelling (1♀, LACM). **Mono:** 11 mi N Bridgeport, 7 July 1961, PMM (1♀, CAS), RMB (1♀, 1♂, UCD); Tom's Place, 2,195 m, 4–5 July 1967, PMH (1♂, CAS), 1 mi S Tom's Place, 8 Aug 1962, LAS (1♂, UCD). **Riverside:** Bautista Canyon 11 mi SE Hemet, 9 June 1974, KWC (1♀, CAS); San Timoteo Canyon, 14 Sep 1972, MSW and A. Hardy (2♀, CAS, 1♀, CSDA). **San Bernardino:** Cajon, 17 July 1956, H. R. Moffitt (1♀, UCD); Cleghorn Campground (14 mi N San Bernardino), 27 Sep 1975, D. Burnett (1♀, CSDA), Mid Hills, TLG, 16 June 1980 (1♀, TLG), 19–27 June 1980 (1♂, TLG); Mountain Home, 12 Sep 1953, EIS (1♀, UCD); San Bernardino Mts. 12 mi S Mentone, 11 July 1956, RCB (1♀, UCD), Thurman Flats Picnic Area, 22 Oct 1965, PHA (1♀, CAS), Wildwood Canyon 3 mi E Yucaipa, 15 June 1976, TLG (1♀, TLG). **San Diego:** Culp Canyon in Anza Borrego State Park, 12 June 1958, EIS (1♀, UCD); Mount Laguna, 5 July 1963, JAP (1♂, CIS); Pine Valley, 6 Aug 1977, Lee Guidry (1♀, SDNH). **Santa Barbara:** Santa Ynez Mts., 24 June 1959, PMM (1♀, UCD). **Santa Clara:** San Antonio Valley (3.5 mi N Del Puerto Canyon road), 21 Aug 1962, JAP (1♀, CIS). NEVADA. **Douglas:** Minden, RMB (1♀, UCD).

MEXICO **Baja California Sur:** 4 mi WSW Miraflores, MSW, 23–24 April 1979 (1♀, CAS).

Tachysphex tipai sp. n.

(Figures 69, 70)

DERIVATION OF NAME.—Named after the Tipai Indians (also called Kimia) of southern California, where the holotype was collected; noun in apposition.

DIAGNOSIS.—The female of *tipai* has: vertex setae erect; mesothoracic venter sparsely punctate on each side of midline; fore- and midfemora basoventrally without micropunctation but with a few, sparse punctures (Fig. 69d); flagellomeres II–X longer than in most other *Tachysphex* (Fig. 69b) (for example, length of flagellomere II 3.5–4.0 × width). These characters are shared

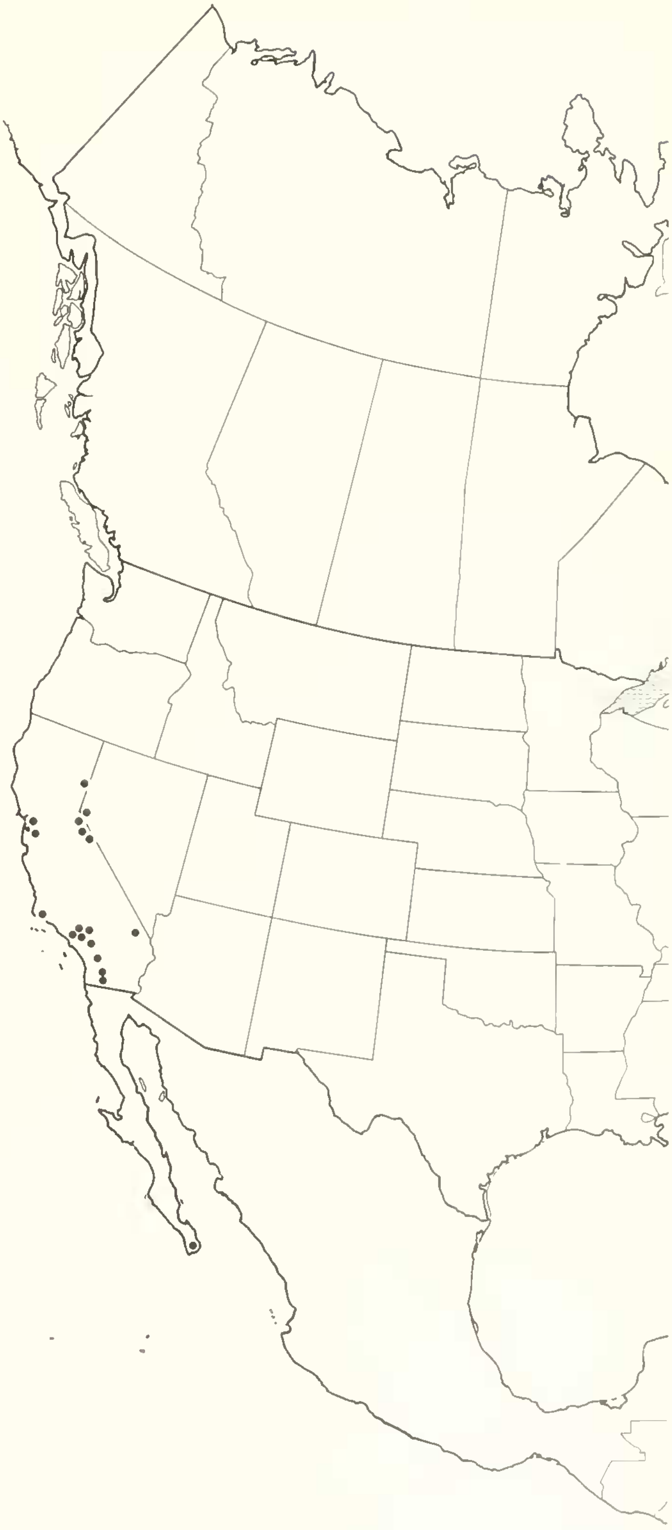

FIGURE 68. Geographic distribution of *Tachysphex sulcatus* sp. n.

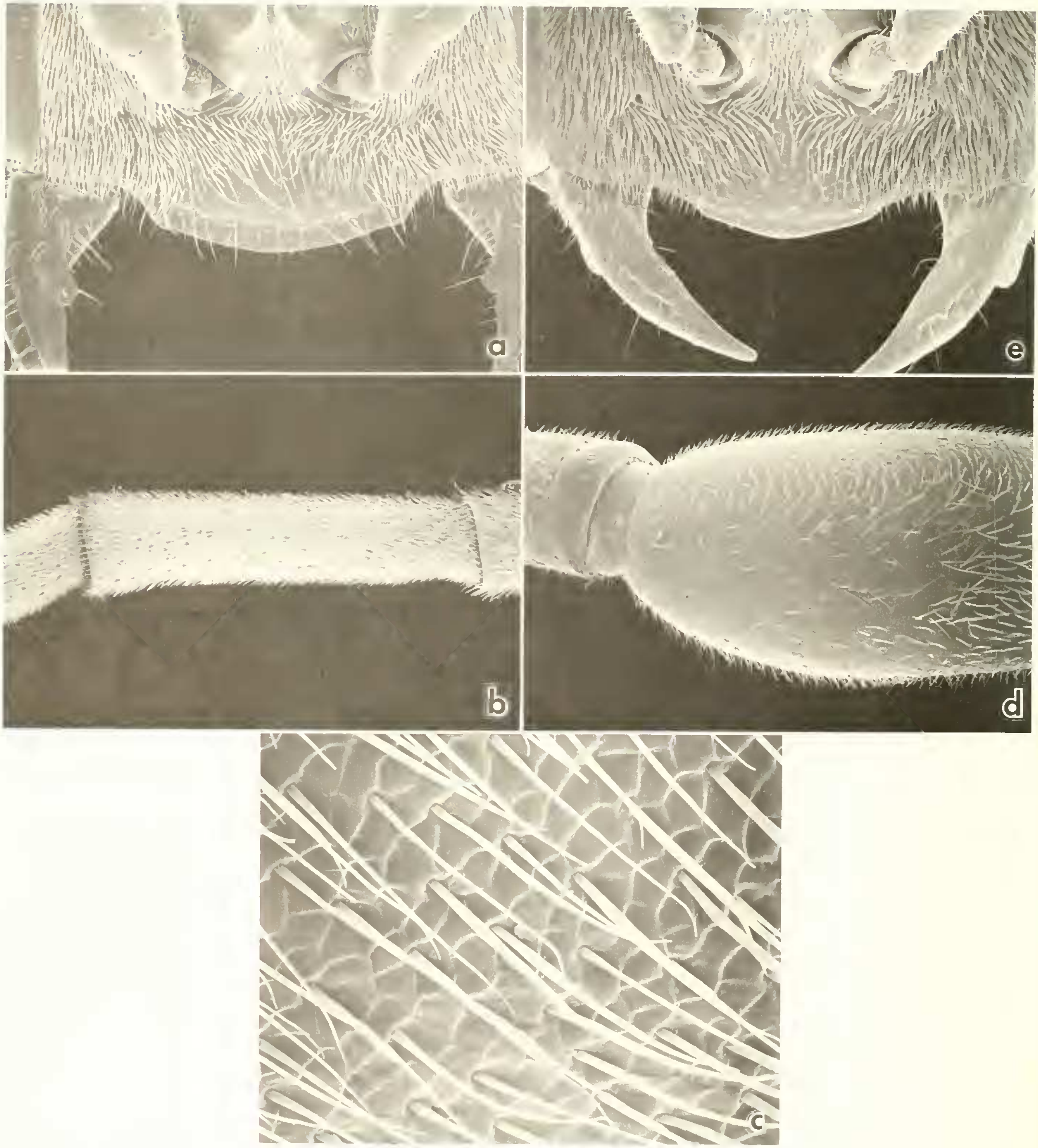

FIGURE 69. *Tachysphex tipai* sp. n.: a—female clypeus, b—female flagellomere II, c—sculpture of female mesopleuron, d—base of female forefemur; e—male clypeus.

with *mirandus*, but in the latter the basal plate of sternum II is broad apically, and the body length is 8.0–12.0 mm. In *tipai*, the basal plate is angulate (acutely or nearly so), and the body length is 6.5–8.0 mm. Furthermore, in many *mirandus* punctures of the lateral clypeal section are larger than those on the adjacent frons (punctures of equal size in *tipai*).

The male of *tipai* has erect vertex setae, the clypeal lobe is indistinctly delimited laterally (Fig. 69e), the inner mandibular margin is not dentate (Fig. 69e), and the mesopleuron is dull, impunctate, or with ill-defined punctures. In most specimens punctures of the mesothoracic venter are many diameters apart on both sides of midline (but no more than one diameter apart in some). The long flagellomere II (length 2.25–2.5 × width) is a subsidiary diagnostic feature. *Tachysphex mirandus* is similar, but its sterna II–IV are sparsely punctate, and the clypeal lip is triangular, whereas in *tipai* sterna II–IV are densely punctate, and the clypeal lip is obtusely angulate to arcuate.

Another recognition feature of *tipai* is the orientation of setae on the propodeal dorsum. In most specimens, all median setae are inclined anterad along the midline, though in some individuals a few basomedian setae are inclined posterad. In most other species of the *pompiliformis* group, many of the basomedian setae are inclined posterad.

Two or three undescribed species are similar to *tipai*. The setae on their propodeal dorsum are conspicuous, mainly parallel to each other, nearly appressed in dorsal view and form an angle of less than 45° with the integument in lateral view, and the male clypeal lobe is well defined, angulate laterally. In *tipai*, the setae on the propodeal dorsum are suberect in dorsal view and form an angle of more than 45° with the body surface in lateral view.

Description.—Clypeal free margin less concave between lobe and orbit than in *antennatus*, *tarsatus*, or *semirufus*. Punctures nearly contiguous on frons, one to two diameters apart on vertex, many diameters apart on mesothoracic venter (but less than one diameter along midline). Mesopleuron evenly microsculptured, impunctate below scrobe (Fig. 69c) or (some males) with shallow, ill-defined punctures. In most specimens mesothoracic venter sparsely punctate (except densely punctate along midline), but punctures no more than one diameter apart in a male from Alamos, Mexico (CAS). Propodeal dorsum and side microareolate, side of some individuals with vestigial microridges when seen from certain angles; hindface ridged. Hindcoxa not carinate.

Vestiture not entirely concealing integument between antennal socket and orbit. Setae erect on vertex, about 1.0 MOD long; oriented posterolaterad on scutum at middle; inclined on mesopleuron; on propodeal dorsum forming an angle wider than 45° with integument in lateral view, oriented anterad along midline, or (some specimens) a few basomedian setae oriented posterad; appressed or nearly so on midfemoral venter.

Head and thorax black. Gaster red (female, some males) or (most males) base of tergum I and terga IV–VII or V–VII brown or black; gaster all black in a male from Alamos, Mexico. Legs black in most specimens, with tarsal apex brown, but hindtibia red apicoventrally in some females from Borrego Valley, all tibia red in single female from Andreas Canyon, California, and legs largely red in single female from El Golfo, Mexico (red are: midtibia largely, hindfemur, hindtibia, and all tarsi). Frontal vestiture silvery. Gastral terga I–IV (female) or I–V (male) silvery fasciate apically. Wings hyaline or slightly infumate.

♀.—Clypeus (Fig. 69a): bevel longer than basomedian area, lip evenly arcuate, not emarginate mesally or incised laterally. Dorsal length of flagellomere I (Fig. 69b) and II 2.75–3.25 and 3.5–4.0 × apical width, respectively. Vertex width 1.1–1.3 × length. Punctures of scutal disk up to two diameters apart. Discal micropunctures of tergum II several diameters apart. Tergum V with a few, sparse punctures, apical depression impunctate. Mid- and hindtrochanteral venter shiny, impunctate. Fore- and midfemora basoventrally without micropunctures, but with a few, sparse punctures (Fig. 69d) that are evanescent in some individuals. Length 6.5–8.0 mm.

♂.—Inner mandibular margin not dentate (Fig. 69e). Clypeus (Fig. 69e): bevel shorter than basomedian area, lip evenly arcuate or obtusely angulate, its lateral corner not prominent (clypeal free margin not or scarcely angulate on each side of lobe); distance between corners equal to 1.1–1.3 of clypeal length, equal to 0.9–1.1 of distance between corner and orbit. Dorsal length of flagellomere I 1.7–2.2 × apical width; length of flagellomere II 2.25–2.5 × width. Vertex width 1.4–1.6 × length. Punctures of scutal disk almost contiguous. Sterna evenly punctate from base to hindmargin or punctures evanescent on apical depression of sterna II–V; punctures finer than those of mesothoracic venter. Forefemoral notch covered with microscopic, suberect setae. Forebasitarsus without preapical rake spines; outer apical spine of foretarsomere II equal to tarsomere width or shorter. Length 4.8–5.8 mm.

Sternal pubescence not velvety.

Life History.—Unlike most species of the *pompiliformis* group, *tipai* is a katydid collector. Two females examined are pinned with young katydid nymphs, both Decticinae, determined by D. C. F. Rentz. One female is from Borrego Valley, California (UCD), and the prey is *Atelophus notatus* Scudder. The other is from Kingsville, Texas (TAI), and the prey is *Pediodectes* sp. Some specimens from Apple Valley, California, were collected on flowers of *Euphorbia albomarginata* T. and G., and the single female from Sierra Juárez, Baja California Norte was collected on *Hyptis emoryi* Torr.

Geographic Distribution (Fig. 70).—California, Arizona, Utah, southern Texas, and northern Mexico (Sonora, Baja California), mainly sandy areas including deserts.

Collecting Period.—24 February (Alamos, Sonora) to 28 May (Vacaville area, California).

Material Examined.—Holotype: ♀, California: Riverside Co., 18 mi W Blythe, 23 March 1983, WJP (CAS, Type #15028).

Paratypes: 88♀, 48♂ (specimens for which depository is not indicated are all in UCD): UNITED STATES: ARIZONA: **Cochise:** 14 mi W Tombstone, RMB (1♂), FDP (2♂, CAS, UCD). **Maricopa:** 18 mi S Gila Bend, S. A. Gorodenski, J. M. Davidson, M. A. Cazier (1♀), 3 mi SW Wickenburg, P. Torchio and GEB (1♀, USU). **Pima:** Organ Pipe Cactus National Monument, G. L. Jensen and W. J. Turner (1♂, WSU); Santa Catalina Mts., F. W. Werner, J. C. Bequaert, H. Elton, M. Nurein: Sabino Canyon (1♀, UAT) and Molino Basin (1♀, UAT). **Santa Cruz:** Nogales, Ex R. C. L. Perkins collection (4♀, including one with missing gaster, BMNH). **Yavapai:** 8 mi N Aguila, FDP (1♀, USU). **Yuma:** Quartzsite: 4 mi S, JWMS (1♀, CIS); 7 mi S, WJP (1♀, CAS), 14 mi S, R. O. Schuster (1♀), 32 mi S, DSH (2♀), D. R. Miller (1♀). CALIFORNIA: **Alameda:** Arroyo del Valle, W. J. Turner (1♀, CIS). **Amador:** Pioneer, O. W. Richards (1♀, 1♂, BMNH), Volcano, MEI (1♀). **Colusa:** 21 mi SW Williams, D. R. Miller (1♀). **El Dorado:** Kyburz, S. C. Kuba (1♀, CAS). **Fresno:** 12 mi W Coalinga, JWMS (1♀). **Imperial:** S end of Chocolate Mts. (Ogilby road 3 mi S junction with Highway 78), MSW and J. Slansky (1♀, 1♂, CSDA), 2 mi NW Glamis, JAP (1♂, CIS), Ogilby road 6 mi N junction with Yuma–San Diego road, MSW and J. S. Wasbauer (1♀, CAS; 1♀, 1♂, CSDA); 3 mi S Palo Verde, C. A. Toschi (1♀, CIS). **Inyo:** Death Valley (Wildrose Canyon), R. M. Brown (1♀, CAS); Deep Springs, MSW and J. S. Wasbauer (1♂, CSDA); Surprise Canyon (Panamint Mts.), JAP (1♀), Townes Pass, F. G. Andrews (1♀, CSDA). **Kern:** Dove Spring Canyon (¾ mi N Ricardo, W Highway 6), C. A. Toschi (1♀, CIS); Dove Well, P. Rude (1♂, CIS); Short Canyon (6 mi W Inyokern), JWMS (1♀, 2♂, CIS); 2 mi W Woffard Heights, C. A. Toschi (1♀, CIS). **Mendocino:** North California Coastal Range Preserve, 5 mi N Branscomb, REC (1♀, CIS). **Mono:** Paradise Camp, ASM (1♀). **Riverside:** Andreas Canyon, RMB (1♀), 18 mi W Blythe, DSH (1♀), MEI (1♀), WJP (1♀, CAS); Pinon Flat, FXW (1♂, CAS). **San Bernardino:** Apple Valley, PDH (2♀, 1♂), 5 mi W Essex, D. R. Miller (2♂); Granite Pass, J. C. Hall (1♀, USNM); 12 mi SE Ivanpah, B. J. Adelson (3♀), PDH (1♂),

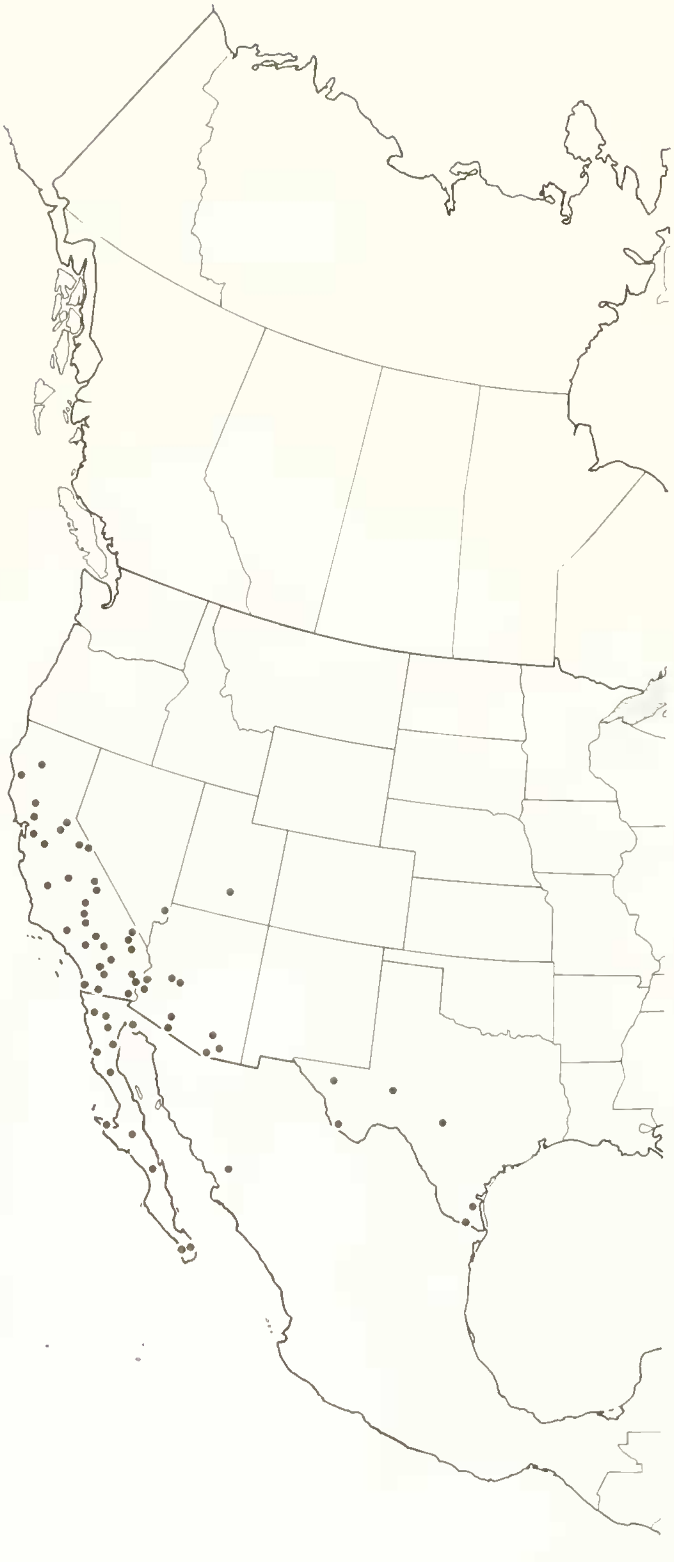

FIGURE 70. Geographic distribution of *Tachysphex tipai* sp. n.

Kramer Hills, J. C. Hall (1♀, CAS, 2♀, 1♂, UCD), Kramer Junction, EIS (1♀), Mid Hills, TLG (1♀, TLG); 1 mi S Mojave River Forks in San Bernardino Mts., E. I. Fisher (1♂, CSDA); upper Morongo Valley, R. B. Roberts (1♀, OSU); Pipes Canyon (6 mi W Pioneertown), TLG (1♀, CAS), Providence Mts., TLG (1♀, CAS, 4♀, TLG); Sacaton Springs (New York Mts.), TLG (1♀, CAS), Twentynine Palms, KWC (1♀, CAS), Yucca Valley, KWC (1♀, CAS). **San Diego:** Borrego State Park (Coyote Canyon), MEI (1♂, UCR), Borrego Valley, RMB (1♀, CAS; 3♀, UCD); near Buckman Springs, FXW (1♂, CAS); Torrey Pines State Park, R. B. Parks (1♀, SDNH). **Solano:** Cold Creek (11 mi N Vacaville), G. C. Eickwort (1♀, CU). **Stanislaus:** Del Puerto Canyon (Frank Raines Park), PHA (1♀, CAS). **Trinity:** Hayfork, J. A. Chemsak (1♀, CIS), Hayfork Ranger Station, JAP (1♀, CIS). **Tulare:** Ash Mountain (Kaweah Power Station), D. J. Burdick (1♀, CAS). **Ventura:** Hungry Valley (5 mi S Gorman), PDH (5♂, CAS, 7♂, CIS), C. W. O'Brien (1♀, CIS). NEVADA. **Clark:** Saint Thomas Gap (ca. 15 mi SE Overton), R. C. Bechtel and J. B. Knight (1♀, NSDA). TEXAS. **Culberson:** 26 km N Van Horn, TLG (1♀, CAS). **Hidalgo:** McAllen Botanical Garden, C. C. Porter (1♂, FSCA). **Kimble:** Junction, WJP (2♀, 2♂, CAS). **Kleberg:** Kingsville, Jim Johnson (1♀, TAI). **Presidio:** 3 mi E Presidio, HEE (1♀, MCZ). **Upton:** Rankin, Michener and Beamer (2♂, KU). UTAH. **Garfield:** Calf Creek, TLG (1♀, UCD).

MEXICO. **Baja California Norte:** Cataviña, WJP (1♀, CAS); Diablito Canyon (E face of Sierra San Pedro Mártir), JAP (1♀, CIS); 19 mi E Ojos Negros, JWB and DKF (1♀, SDNH); San Felipe (1♂, CAS), 40 mi S San Quintin, WJP (1♂, CAS); Sierra Juárez, P. A. Opler (1♀, CIS). **Baja California Sur:** 22 mi ESE Bahía Tortugas, WJP (1♂, CAS); El Pescadero (Playa Los Cerritos), MSW and J. Slansky (2♂, CAS, CSDA), Los Barriles, MSW (1♀, CSDA); Punta Abrejos road 15 mi W San Ignacio, MSW (2♀, CSDA); 11 mi NE San Isidro, N. Bloomfield and DKF (1♀, SDNH); E edge of Sierra Placeres (27°35′N, 114°30′W), WJP (1♂, CAS). **Sonora:** Alamos, PHA (4♀, 4♂, CAS); 6 mi N El Golfo, MSW (1♀, CSDA).

Tachysphex mirandus Pulawski

(Figures 71, 72)

Tachysphex mirandus Pulawski, 1982:32, ♀, ♂. ! Holotype: ♀, California: San Bernardino Co., Palm Springs (USNM).

DIAGNOSIS.—Terga I–IV are asetose (except somewhat pubescent laterally) in females of *mirandus*, some females of *semirufus*, and some females of *tipai*. In other species terga II–IV are finely setose throughout, though the setae may be partly worn off in old specimens. Unlike *semirufus*, the fore- and midfemoral venter of *mirandus* is not uniformly micropunctate, but has several sparse punctures with alutaceous interspaces (Fig. 71b). Unlike *tipai*, the basal platform of sternum II is broad apically in *mirandus* (acutely angulate or nearly so in *tipai*).

The male of *mirandus* can be recognized by the mesally nonpubescent, largely glossy, and sparsely punctate sterna II–VI, combined with the nondentate mandibular inner margin, triangular clypeal lip (Fig. 71c), and the clypeal free margin not angular between the lip and the lateral section.

Subsidiary recognition features of both sexes are: punctures larger on lateral clypeal section than on adjacent frons (the difference is slight in some specimens); mesopleural setae erect or nearly so (almost as in *semirufus*); horizontal part of mesothoracic venter in most specimens glossy and sparsely punctate (as in most *tipai*), contrasting with the dull, strongly microsculptured mesopleuron.

DESCRIPTION.—Frons below midocellus punctatorugose to sparsely punctate. Punctures one or two to many diameters apart on vertex and scutum (except subcontiguous near scutal margins); several diameters apart (but one diameter in some females) on horizontal portion of mesothoracic venter; mainly several diameters apart on trochanteral venter. Vertex alutaceous, concave in most specimens. Mesopleuron dull, microareolate to coarsely microsculptured, with shallow, inconspicuous punctures that are about one diameter apart on prepectus. Horizontal part of mesothoracic venter (except in specimens with dense punctation) and trochanteral venter shiny, alutaceous. Propodeal dorsum microareolate; side microareolate, also microridged in most specimens; hindface ridged or (some specimens) ridges evanescent. Hindcoxa not carinate. Midfemur (also fe-

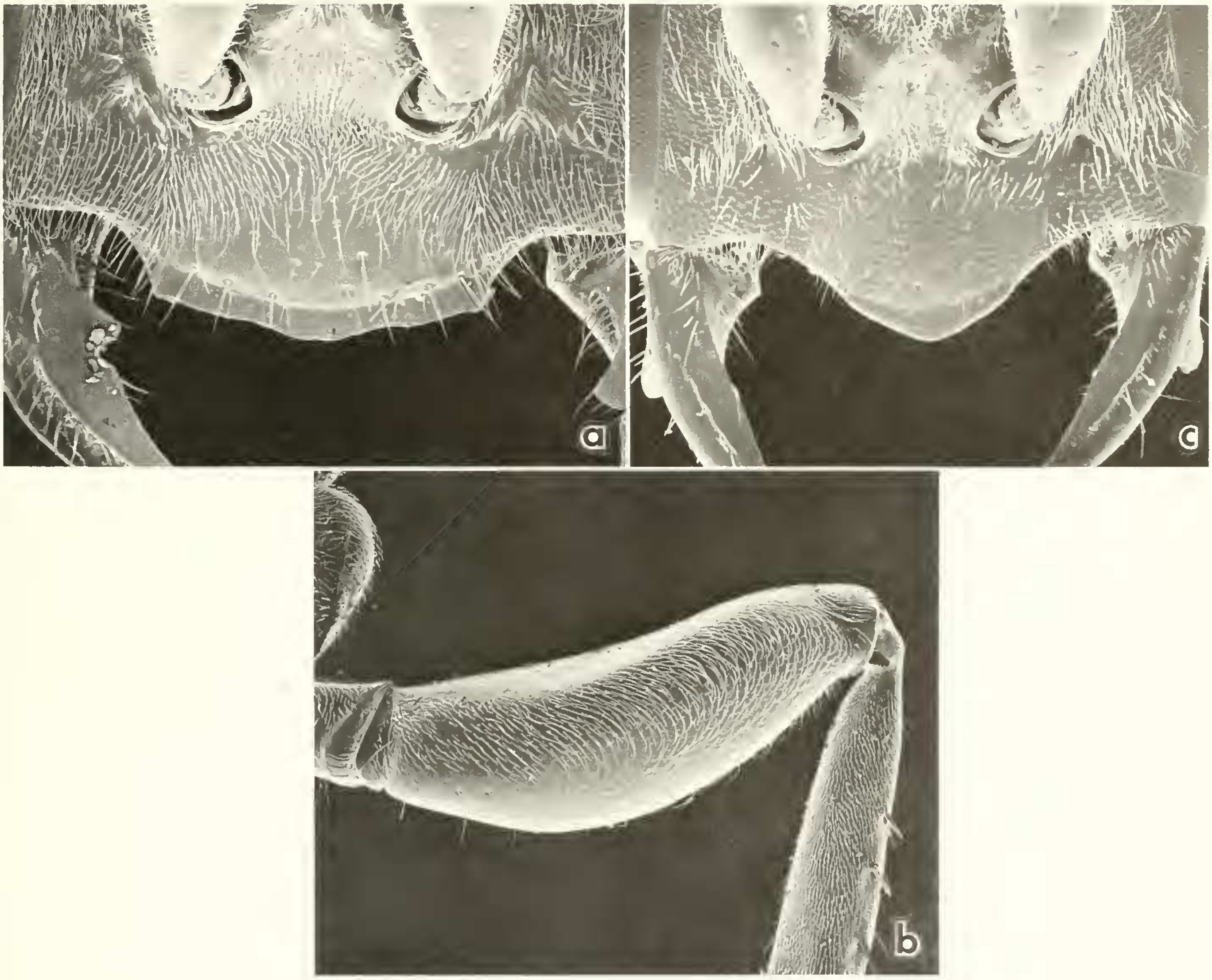

FIGURE 71. *Tachysphex mirandus* Pulawski: a—female clypeus; b—female midfemur; c—male clypeus.

male forefemur) basoventrally alutaceous or unsculptured, with a few, sparse punctures (Fig. 71b).

Setae erect, 1.0 MOD long on vertex; suberect to appressed on scutum, 0.6 MOD long anterolaterally, longitudinally to transversely oriented at middle; 1.0 MOD long on mesopleuron; suberect on distal half of midfemoral venter, 0.5–0.6 MOD long in female, about 1.0 MOD long in male. Most setae of propodeal dorsum inclined anterad (almost erect in some specimens).

Head and thorax black, gaster red. Fore- and midfemur black, female hindfemur black or red, male hindfemur partly red. Fore- and midtibia black, hindtibia red or (some females) black. Tarsi black or (males, some females) midtarsal apex and hindtarsus red. Terga not fasciate. Wings hyaline. Frontal vestiture silvery.

♀.—Clypeus (Fig. 71a): bevel longer than basomedian area; lip sinuate, obtusely produced mesally, not incised laterally. Dorsal length of flagellomere I 2.6–3.0× apical width. Vertex width 1.0–1.1× length in most specimens (vertex concave), but 1.6× length in a female from Panoche, California (vertex flat). Terga II–V alutaceous, glabrous except somewhat pubescent laterally. Length 8–12 mm.

♂.—Mandibular inner margin not dentate (Fig. 71c). Clypeus (Fig. 71c): free margin not angulate or scarcely angulate between lip and lateral section; lip triangular; bevel about as long as basomedian area. Dorsal length of flagellomere I 2.0–2.2× apical width. Vertex width 1.3–1.5× length. Terga with minute punctures that are several diameters apart on tergum II, interspaces alutaceous or unsculptured; most punctures of tergum VII more than one diameter apart. Sterna II–VI not pubescent (except laterally), glossy, sparsely punctate (except dull, densely microsculptured basally sterna II–V). Forefemoral notch shiny, glabrous. Forebasitarsus with four preapical rake spines; outer apical spine of foretarsomere II longer than foretarsomere III. Length 8.5–9.0 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 72).—Xeric areas of Arizona, Nevada, southern California, and Baja California.

COLLECTING PERIOD.—Markedly earlier than for most other

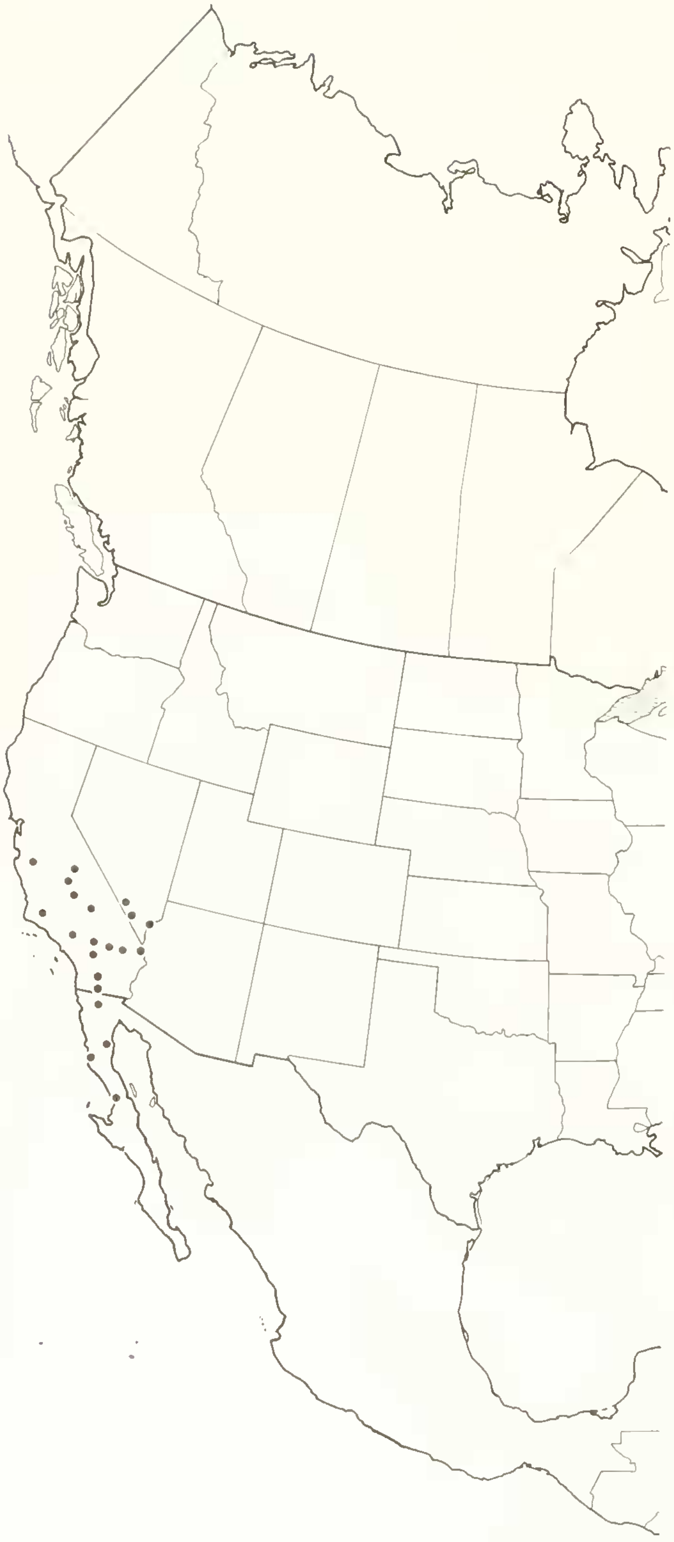

FIGURE 72. Geographic distribution of *Tachysphex mirandus* Pulawski

species: 20 January to 14 April; a very worn specimen was collected near Pioneertown, California on 5 May.

MATERIAL EXAMINED.—31♀, 7♂ (CAS, CIS, CSDA, UCD, UIM, USNM, WJP).

RECORDS.—UNITED STATES: ARIZONA: **Mohave:** 4 mi S Hoover Dam. CALIFORNIA: **Fresno:** Pinoche (28 Mar). **Imperial:** 9 mi W Coyote Wells (26 Mar), Ocotillo (22 Mar), Yuha Desert (15 Feb). **Inyo:** S end of Owens Valley (25 Mar). **Kern:** 3 mi NW Indian Wells (12 Apr), Short Canyon 7 mi NW Inyokern (15 Mar) and 6.5 mi N Inyokern (12 Apr), 7 mi E Walker Pass (25 Apr). **Los Angeles:** Little Rock (22 and 28 Mar). **Riverside:** Palm Springs (11 Feb), Whitewater (14 Apr). **San Benito:** Panoche (29 Mar). **San Bernardino:** 5 mi S Essex (26 Mar), Needles (5 Mar), 14 mi E Newberry (31 Mar), 7 mi NW Pioneertown (5 May), Trona (4 Apr). **San Diego:** Borrego Valley (2 and 11 Apr), Borrego Springs (30 Mar). **San Luis Obispo:** Cuyama Valley 30 mi W Maricopa (21 Mar). **Tulare:** Kaweah Power House (20 Jan). NEVADA: **Nye:** Johnnie (28 Mar), 16 mi E Lathrop Wells (1 Apr), Mercury (28 Mar, 24 Apr).

MEXICO: **Baja California Norte:** 21 mi ESE El Rosario (17 Mar); Sierra Juárez: Upper Cantillas Canyon (19 Mar), E face of Sierra San Pedro Mártir: Diablo Canyon (6 Apr). **Baja California Sur:** 16 mi E Rosarito (26 Mar).

Tachysphex verticalis Pulawski

(Figures 73, 74)

Tachysphex verticalis Pulawski, 1982:36, ♀, ♂. ! Holotype: ♀, California: Riverside Co.: 9 mi W Beaumont (UCD).

DIAGNOSIS.—*Tachysphex verticalis* differs from other species of the *pompiliformis* group in having a uniformly areolate mesopleuron (Fig. 73b) and propodeal side, and constrastingly ridged propodeal hindface. In addition, the longer than wide vertex (slightly wider than long in some females) is distinctive, as is the markedly convex middle section of the clypeus. In the female, the clypeal lip has two lateral incisions (Fig. 73a), as in *crenulatus* and *glabrior*; the vertex has a shiny, median sulcus that extends posterad from the postocellar impression; and the pygidial plate is broad apically (Fig. 73c). In the male, sterna III–VI have well-developed graduli (as in *glabrior*, *idiotrichus*, and *irregularis*). Because of the narrow vertex and microareolate thorax side, *verticalis* may be confused with species of the *brullii* subgroup. However, the female tarsomere V is simple (apicoventral margin not expanded into a lobe, claws short, not prehensile). In the male, setae of the propodeal dorsum oriented anterad from the base to apex combined with the impunctate mesopleuron are distinctive.

DESCRIPTION.—Vertex with shiny, longitudinal sulcus that emerges from postocellar impression. Mesopleuron and propodeum dull, impunctate, uniformly microareolate (Fig. 73b) except propodeal hindface ridged, somewhat shiny. Hindcoxa carinate, carina expanded basally.

Scutal setae appressed, at middle oriented posterad; a few scattered setae suberect, about 0.7 MOD long.

Head, thorax, and legs black, tarsal apex brownish (reddish in many specimens), gaster red, with black, basal spot, darkened apically in some males. Terga I–III (I–IV in male) silvery fasciate apically. Wings almost hyaline.

♀.—Clypeus (Fig. 73a): bevel longer than basomedian area; lip weakly arcuate, with two lateral incisions on each side, in some specimens with rudimentary, mesal notch. Dorsal length of flagellomere I 2.0–2.4 × apical width. Frons dull, microsculptured, punctate, most punctures on upper half about one diameter apart. Vertex width 0.9–1.1 × length. Vertex punctures in most specimens subcontiguous mesally, many diameters apart near orbit and (some individuals) on whole surface. Scutum microsculptured, evenly punctate, discal punctures about one diameter apart. Tergum V with a few, scattered punctures, its apical depression impunctate. Pygidial plate shiny, its punctures dense to (some individuals) sparse, its apex broader than average in the *pompiliformis* group (Fig. 73c). Forefemoral venter impunctate, microsculptured, somewhat shiny. Length 8–10 mm.

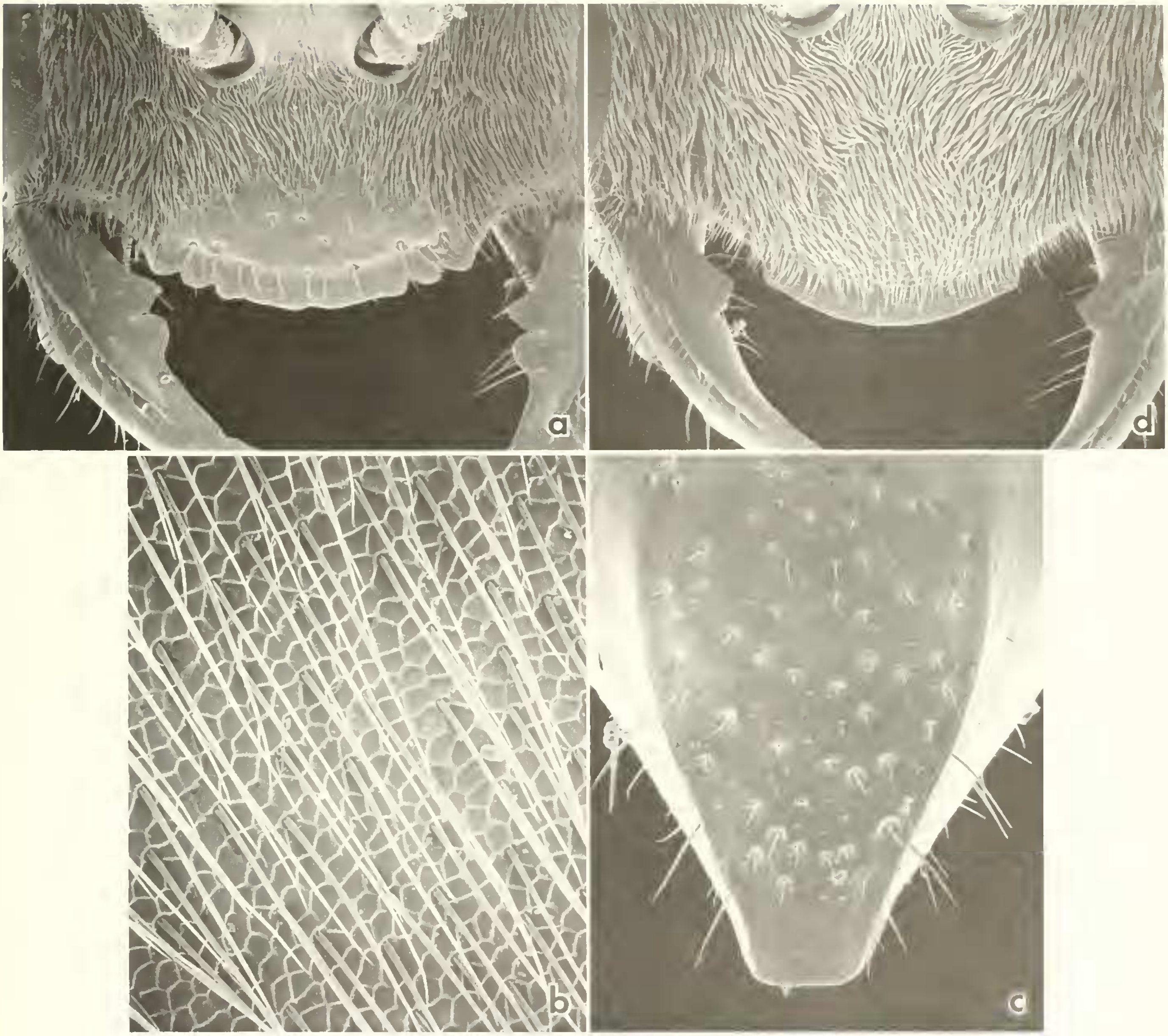

FIGURE 73. *Tachysphex verticalis* Pulawski: a—female clypeus; b—mesopleural sculpture of female; c—pygidial plate of female; d—male clypeus.

Setae erect, 1.0–1.3 MOD long on vertex; 1.7–2.0 MOD long on lower gena; appressed or erect, slightly less than MOD, on midfemoral venter.

♂.—Mandibular inner margin with tooth (Fig. 73d). Clypeus (Fig. 73d): bevel dull, indistinct, or absent; lip evenly arcuate, its lateral corners obtuse, closer to orbit than to each other. Dorsal length of flagellomere I 1.3–1.6× apical width. Frons dull, microsculptured, shallowly, indistinctly punctate, punctures almost contiguous. Vertex microsculptured, punctate, punctures less than one diameter apart anteriorly and mesally, at least one diameter apart near orbit behind postocellar impression; vertex width 0.7–0.9× length. Scutal punctures even, subcontiguous. Terga densely microsculptured, but some discal micropunctures of tergum II two to three diameters apart. Sterna finely, densely punctate throughout, sterna III–VI with graduli. Forefemoral notch pruinose. Foretarsus without rake; outer apical spine of foretarsomere II much shorter than foretarsomere III. Length 5.5–9.0 mm.

Setae erect, 1.1–1.3 MOD long on vertex; 1.4–1.6 MOD long on lower gena. Femoral vestiture appressed.

Frontal vestiture golden above or with golden tinge, rarely silvery.

LIFE HISTORY.—A male from Meyer Canyon, California (CSDA) was collected on flowers of *Eriogonum fasciculatum* Benth.

GEOGRAPHIC DISTRIBUTION (Fig. 74).—Northern Mexico, California and adjacent areas of northern Nevada, Arizona and Utah; also isolated in Idaho.

MATERIAL EXAMINED.—116♀, 208♂.

RECORDS.—UNITED STATES: ARIZONA: **Cochise:** Bisbee, Box Canyon (Chi-

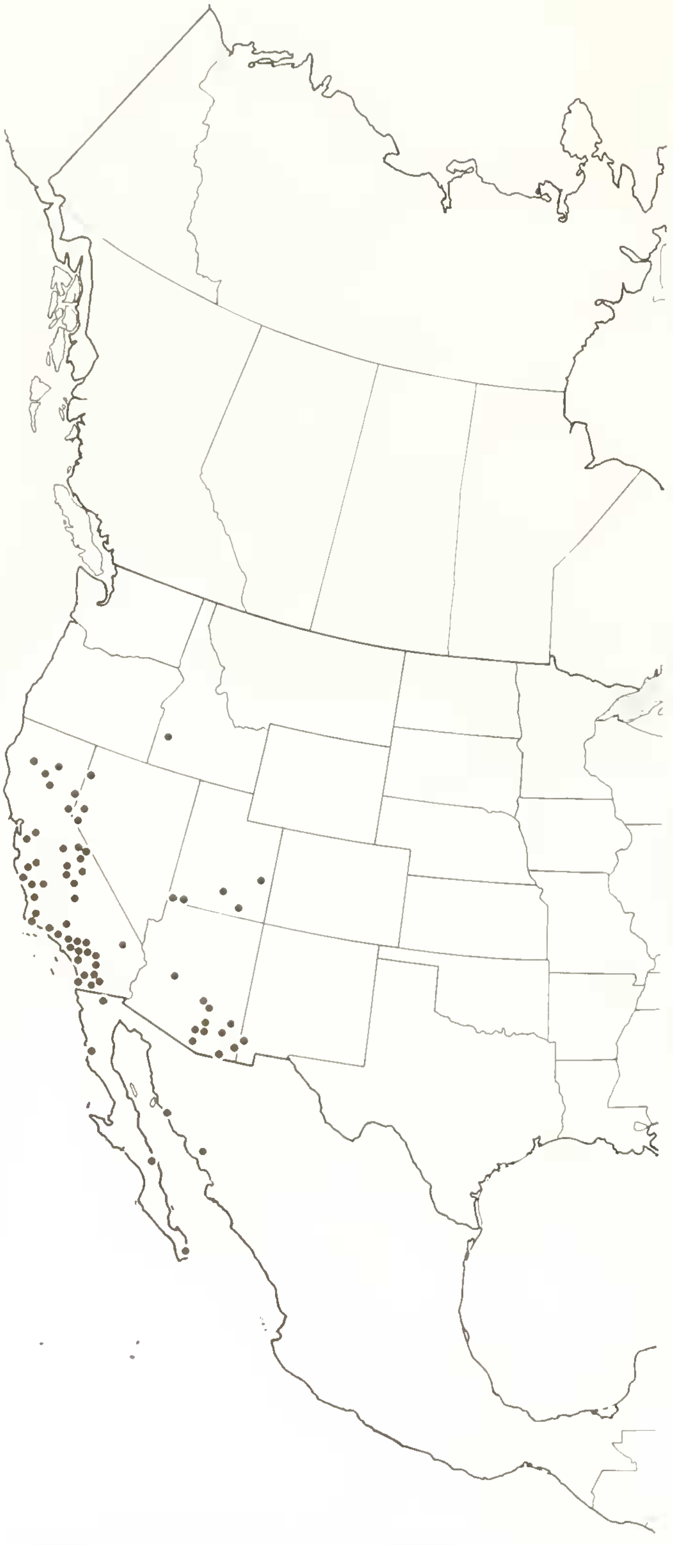

FIGURE 74 Geographic distribution of *Tachysphex verticalis* Pulawski

icahua Mts.), Portal, Skeleton Canyon (6 mi SE Apache), 2 mi E Willcox. **Gila:** ila River 3 mi SW Christmas. **Graham:** Roper Lake State Park. **Pima:** Baboquivari Mts., Gates Pass, 2 mi E Robles Pass, Sabino Canyon, Tanque Verde, Tucson. **Pinal:** Boyce Thompson Arboretum (3 mi W Superior). **Yavapai:** Congress. CALIFORNIA: **Alameda:** Tesla Road. **Butte:** 1 mi NE Pulga. **Fresno:** Barton Flat, 13 mi W Cedar Grove, Hume Lake, Warthan Canyon. **Inyo:** Antelope Springs (8 mi SW Deep Springs), 3 mi W Big Pine, Big Pine Creek, 10 mi N Bishop, Lone Pine Creek, Symmes Creek, Westgard Pass (also 4 mi W). **Kern:** 2 mi W Frazier Park, Kernville. **Lassen:** Hallelujah Junction. **Los Angeles:** Camp Baldy, Charlton Flat (San Gabriel Mts.), Claremont, Crystal Lake Road, Elizabeth Canyon, Gorman, La Crescenta, Little Eaton Canyon, Mt. Wilson Road, Monrovia, Saugus, Santa Susana Pass, Tanbark Flat in San Gabriel Mts. **Mariposa:** Jerseydale (12–14 mi NE Mariposa). **Monterey:** Mill Creek (Santa Lucia Mts.), Paraiso Springs, 4 mi S San Ardo, 4 mi W Soledad. **Orange:** Hot Springs Canyon, Upper Trabuco Canyon. **Placer:** Lake Tahoe. **Riverside:** Anza, Banning, 9 mi W Beaumont, Park near Idyllwild, Pinyon Flat, Riverside, San Timoteo Canyon, Whitewater. **San Benito:** New Idria Road 4 mi SW junction Panoche Road. **San Bernardino:** Cajon, Cajon Junction, Hole-in-the-Wall (Providence Mts.), Meyer Canyon Road (5 mi NW Devore), Mill Creek Canyon, Oak Glen, Upper Santa Ana River, Wildwood Canyon, 3 mi SE Yucaipa. **San Diego:** Julian, Laguna Mts. road, La Jolla, Lake Henshaw, Little Cedar Canyon, Point Loma, Poway, Rose Canyon, San Diego (Mission Gorge), Scissors Crossing, Sorrento, Torrey Pines State Park, Warner Springs (also 9 mi S). **San Luis Obispo:** Creston, Nacimiento Dam, 3 mi NW Paso Robles. **Santa Barbara:** Bluff Camp (San Rafael Mts.), 3 mi W Cachuma Lake, Davey Brown Campground (12 mi NE Los Olivos), Los Prietos, Santa Ynez Mts., Surprise Stone. **Santa Clara:** San Antonio Valley (3.5 mi N Del Puerto Canyon road). **Shasta:** Hot Creek Post Office, Redding. **Stanislaus:** Del Puerto Canyon. **Trinity:** Junction City, 3 mi W Weaverville. **Tulare:** Ash Mountain (Kaweah Power Station), Three Rivers. **Ventura:** Foster Park, Sespe Canyon, Wagon Road No. 2 Campground (18 air mi WSW Gorman). IDAHO: **Owyhee:** 2 mi SW Murphy. NEVADA: **Douglas:** 3 mi S Genoa, Minden. **Storey:** Geiger Summit. **Washoe:** 54 mi NW Gerlach. NEW MEXICO: **Hidalgo:** Granite Gap (18 mi N Rodeo). UTAH: **Garfield:** Bullfrog Creek area near Lake Powell, Calf Creek, Escalante River. **Grand:** Moab. **Washington:** Leeds Canyon, Paradise Canyon, Snow Canyon.

MEXICO: **Baja California Norte:** 10 mi E Bahia San Quintin, 4 mi S La Rumorosa, San Quintin. **Baja California Sur:** 4 mi WSW Miraflores, 17 mi S Mulegé. **Sonora:** Cócorit, 6 km NNW San Carlos.

Tachysphex opata sp. n.

(Figures 75, 76)

DERIVATION OF NAME.—Opata is a Pima Indian word meaning "hostile people," "enemies," and referring to an Indian tribe that lived in northwestern Mexico and southeastern Arizona (where the holotype was collected); noun in apposition.

DIAGNOSIS.—*Tachysphex opata* has a finely, evenly punctate mesopleuron combined with a nonridged propodeal side (microridged in many females) and an apically nondepressed sternum I. A subsidiary recognition feature is the glabrous anterior portion of the propodeal side (along the metapleuron). Sternum II is distinctive in most females: the hindmargin of its basal plate is biemarginate (Fig. 75b), although the emarginations are ill defined (Fig. 75c) or absent in some specimens. Occasional females of *pinal* also have a biemarginate basal plate. Most *opata* have radially oriented midscutal setae that form a rosettelike pattern (as in *ashmeadii*, some *crassiformis*, and some *yolo*), but in some individuals the midline setae are oriented contrastingly posterad, as in *texanus* and its relatives. Unlike *ashmeadii*, the male of *opata* lacks graduli, and its clypeal free margin is deeply concave between lobe and orbit; furthermore, the labrum is nearly flat in *opata* but is markedly convex in most *ashmeadii* (both sexes). In *texanus* and its relatives, sternum I has an apical depression and the propodeal side is ridged (except some *yolo* and some *yuma*). Unlike *opata*, *crassiformis* has an unusually broad clypeal lobe and a distinctive axilla (see that species for details).

DESCRIPTION.—Middle clypeal section markedly convex. Labrum slightly convex near free margin. Punctures less than one diameter apart on frons, vertex, and scutum, or (some females) midscutal punctures several diameters apart; punctures fine, even, subcontiguous on mesopleuron and mesothoracic venter.

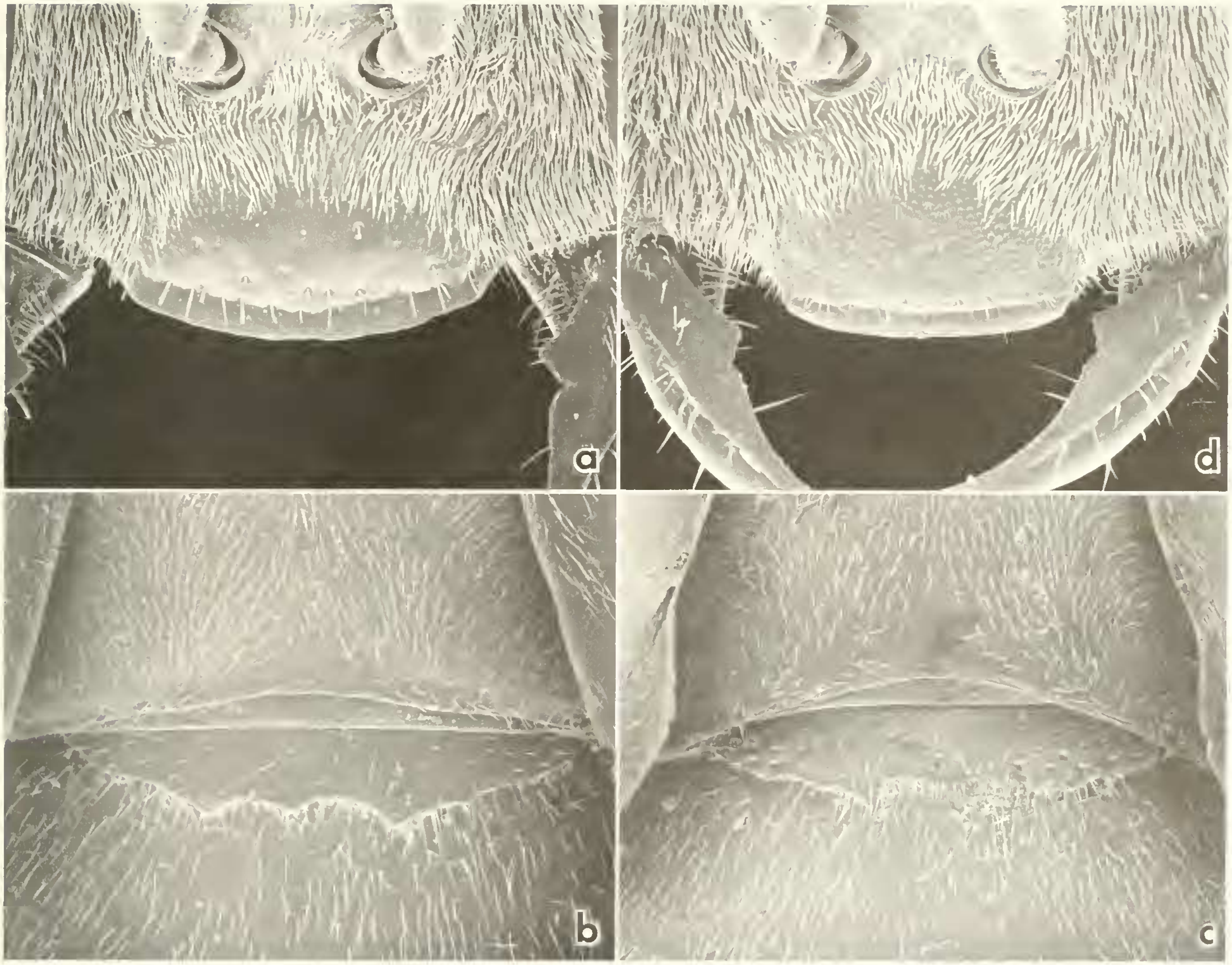

FIGURE 75. *Tachysphex opata* sp. n.: a—female clypeus; b—female sterna I and II, c—same of another specimen, d—male clypeus.

Propodeal dorsum evenly microareolate, hindface ridged. Sternum I without apical depression.

Integument between antennal socket and orbit totally hidden by vestiture as seen from most angles. Setae nearly erect, about 0.7–0.9 MOD long on vertex; inclined on mesopleuron; appressed or nearly so on midfemoral venter; inclined, diverging obliquely anterad on propodeal dorsum; midscutal setae forming rosettelike pattern (all setae of the rosette oriented radially in most specimens, but midline setae oriented posterad in a female from La Mesa, California, one from Coyotes area, Mexico, and one from San Quintín, Baja California Norte). Propodeal side glabrous along metapleuron.

Head, thorax, and legs black, tarsal apex reddish. Gaster red or (males from Baja California Sur) gastral segment I or segments I–II black. Frontal vestiture silvery. Terga I–IV fasciate apically (fascia of tergum IV interrupted). Wings almost hyaline.

♀.—Clypeus (Fig. 75a): bevel longer than basomedian area; lip arcuate, not emarginate mesally, concave (but not really incised) laterally. Dorsal length of flagellomere I 2.0–2.2 × apical width. Vertex width 0.9–1.3 × length. Propodeal side microscopically ridged or (some specimens) microareolate and finely punctate (except impunctate anteriorly). Tergum V sparsely punctate, impunctate on apical depression. Pygidial plate shiny, sparsely punctate. Sternum II setose except glabrous apically; its basal platform in most specimens with biemarginate hindmargin (Fig. 75b, c): with two emarginations that are separated by median projection (emarginations and projection of varying shape, rudimentary or absent in some specimens). Trochanteral venter closely micropunctate. Length 7–10 mm.

♂.—Mandibular inner margin with tooth (Fig. 75d). Clypeus (Fig. 75d): bevel about as long mesally as basomedian area; lip evenly arcuate to nearly straight, separated from bevel by well-defined sulcus; lip corners well defined, separated by distance that equals about 1.2 of clypeal length; clypeal free margin markedly more concave between lobe and orbit than in *ashmeadii*. Dorsal length of flagellomere I 1.6–1.7 × apical width. Vertex width 1.0–1.1 (Baja California Sur) or 1.3–1.5 × (Portal, Arizona) length. Propodeal side microareolate and punctate (except impunctate anteriorly). Sterna evenly, microscopically punctate. Forefemoral notch pruinose. Forebasitarsus without preapical

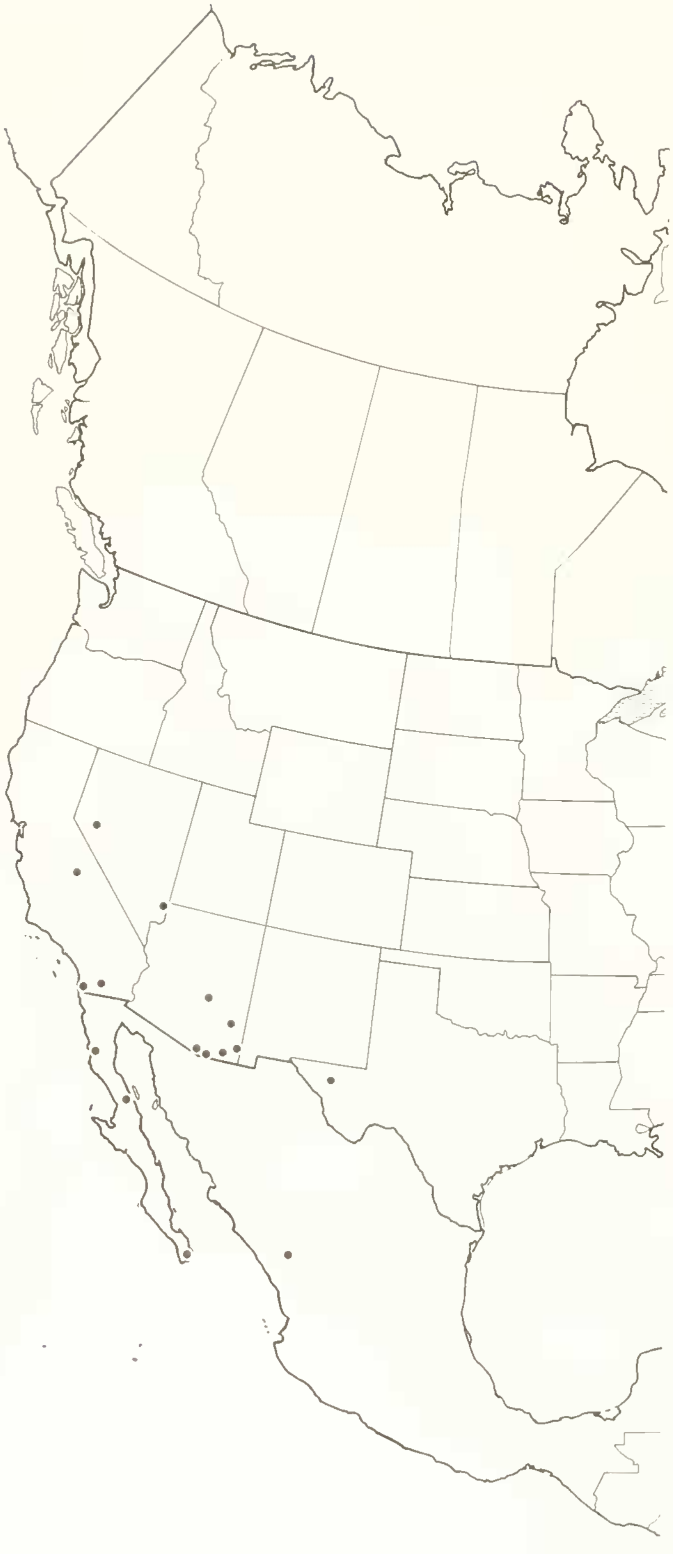

FIGURE 76. Geographic distribution of *Tachysphex opata* sp. n.

rake spines; outer apical spine of foretarsomere II shorter than tarsomere width. Length 7–8 mm.

LIFE HISTORY.—The females from Schurz area, Nevada, were collected on flowers of *Eriogonum inflatum* Torr. and Frém.

GEOGRAPHIC DISTRIBUTION (Fig. 76).—Southeastern Arizona, southwestern Texas, Nevada, southern California, and Mexico (including Baja California).

COLLECTING PERIOD.—30 April to 19 June (U.S.A.), 24 May to 4 Aug (Mexico).

MATERIAL EXAMINED.—Holotype: ♂, Arizona: Cochise Co.: Portal, 27 May 1983, Veronica Ahrens (CAS, Type #15905).

Paratypes (37♀, 14♂). UNITED STATES. ARIZONA. **Cochise:** Portal, same data as holotype (2♂, CAS), 18–19 Apr, WJP (2♂, CAS), 2 mi E Texas Canyon, 11 May, A. D. Telford (2♂, UCD); Tombstone, 15 June, E. C. Van Dyke (1♀, CAS), 30 May, E. E. Klee (8♀, 1♂, CAS). **Gila:** Roosevelt Lake, 11 May, H. and M. Townes (1♀, UCD). **Graham:** Roper Lake State Park, 25 May, WJP (1♀, CAS). **Santa Cruz:** Atascosa Mts., 22 May, G. D. Butler (1♂, UCD); Canelo, 27 May, A. and H. Dietrich (1♂, CU); Nogales, 30 Apr, RMB (1♀, UCD), Tumacacori Mts., Bear Grass Tank, 30 May, Olson (1♀, UAT). CALIFORNIA. **Inyo:** Lone Pine Creek, 6 June, RMB (1♀, UCD). **San Diego:** La Mesa, 19 June, FXW (1♀, CAS); Scissors Crossing–Valle San Felipe, 4 May, R. Hobza (1♂, UCR). NEVADA: **Clark:** Cabin Creek S Mesquite, 15 May, FDP (1♀, USU). **Mineral:** 5 mi NW Schurz, 15 June, R. C. Bechtel and J. P. Young (1♀, CAS, 2♀, NSDA). TEXAS: **Culberson:** 26 km N Van Horn, 9 Apr, TLG (2♂, CAS, USU).

MEXICO. **Baja California Norte:** Angeles Bay, 26 June, E. P. Van Duzee (1♀, CAS), San Quintin, 24 May, FXW (1♂, CAS). **Baja California Sur:** 4 mi WSW Miraflores, J. Slansky, M. K. and C. Wasbauer (5♀, 2♂, CAS, 6♀, 2♂, CSDA); same locality, MSW (2♀, CSDA). **Durango:** 5 mi E Coyotes, 4 Aug, HEE (1♀, MCZ).

Tachysphex hurdi R. Bohart

(Figures 77, 78)

Tachysphex hurdi R. Bohart, 1962:33, ♂, ♀. ! Holotype: ♂, California: Ventura Co.: Hungry Valley 5 mi S Gorman (CAS).—Krombein 1967:393; Bohart and Menke 1976:274. Krombein 1979:1628.

DIAGNOSIS.—*Tachysphex hurdi* has a black body, well-defined mesopleural punctures, sternum I without apical depression, and in most specimens, the midscutal setae are oriented almost uniformly posterad. Some *psammobius* (those with an all black gaster) are similar, but their length is 6–7 mm (female) or 4.5–5.5 mm (male), and the male clypeal lip is triangular. The body length of *hurdi* is 8.5–11 mm (female) or 7–11 mm (male), and the male clypeal lip is variously shaped (Fig. 77b), but not triangular. *Tachysphex glabrior* is also similar, but the vertex setae of *hurdi* (erect, 1.5 MOD long) are distinctive. Unlike *papago*, *psilocerus*, and *scopaeus*, tergum I of *hurdi* is sculptured and pilose throughout. Unlike the Old World *tarsinus* (Lepeletier), the clypeal lip of female *hurdi* has a mesal projection, and the forefemoral notch of most males is glabrous.

DESCRIPTION.—Frons dull or shiny. Vertex width 1.3–1.5× length. Scutum shiny. Punctures deep, well-defined on frons, vertex, and mesothorax, subcontiguous to one diameter apart on frons; slightly more to slightly less than one diameter apart on vertex; less than one diameter apart on scutum (many discal punctures sometimes one diameter apart); less than one diameter apart on mesopleuron (one to two diameters apart posteriorly). Propodeal dorsum rugose, side and hindface ridged. Discal punctures on tergum II more than one diameter apart. Sternum I evenly convex apically, apical depression narrow, hardly visible. Hindcoxa finely ridged along inner margin.

Vestiture not obscuring integument between antennal socket and orbit. Setae erect, 1.5 MOD long on vertex; on scutum suberect, 0.8–0.9 MOD; appressed or suberect (and then almost 1.0 MOD long apically) on midfemoral venter.

Body black, tarsal apex brownish, reddish in most males. Terga I–III or I–IV silvery fasciate apically. Wings slightly infumate to hyaline.

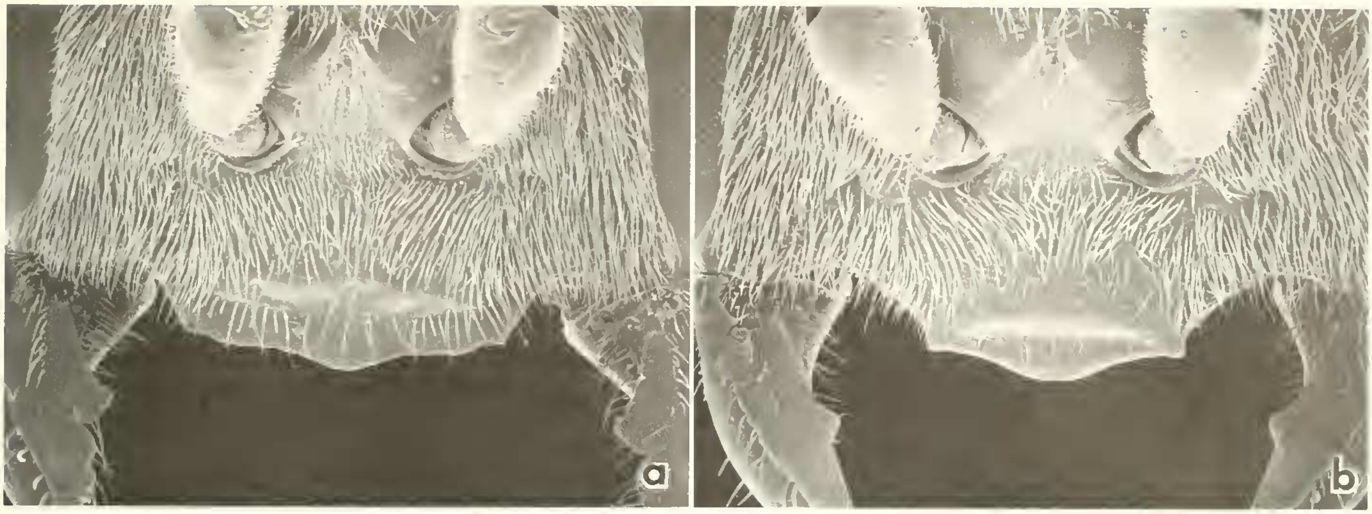

FIGURE 77. *Tachysphex hurdi* R. Bohart: a—female clypeus; b—male clypeus.

♀.—Clypeus (Fig. 77a): bevel swollen to scarcely concave, equal to basomedian area or shorter; lip weakly arcuate, with short, obtuse projection mesally, not incised laterally. Dorsal length of flagellomere I 1.7–2.2× apical width. Tergum V punctate, apical depression impunctate. Trochanters and forefemora finely, densely punctate. Length 8.5–11.0 mm.

♂.—Mandibular inner margin with tooth (Fig. 77b). Clypeus (Fig. 77b): bevel semilunate, distinctly delimited from basomedian area, much shorter than latter, slightly concave to swollen; lip foremargin straight, slightly concave, or sinuate; its corners prominent, as close to orbit as to each other (slightly less in some specimens). Dorsal length of flagellomere I 1.2–1.7× apical width. Sterna punctate throughout. Forefemoral notch glabrous in most specimens, but pruinose in a male from Willow Wash, San Bernardino Co., California (TLG). Foretarsus without rake; outer apical spine of tarsomere II much shorter than tarsomere III. Length 7–11 mm.

VARIATION.—The scutal setae are oriented almost uniformly posterad in most specimens, but the midscutal setae are oriented posterolaterad in a female from the Bonanza area, Utah (USU).

In most specimens, sternal punctures are inconspicuous, finer than those on the mesothoracic venter. They are conspicuous, larger than those on the mesothoracic venter in the following specimens: Arizona: Cochise Co.: 2 mi W Portal (1♂, CAS), Southwestern Research Station 4 mi SW Portal (1♀, 2♂, UCD); Pinal Co.: Boyce Thompson Arboretum 3 mi W Superior (1♀, CAS); county unknown: Oak Creek Canyon (1♀, 1♂, UCD); California: Inyo Co.: Darwin Falls (1♂, UCD); Surprise Canyon in Panamint Mts. (1♂, UCD); Utah: Washington Co.: Paradise Canyon (1♀, USU), Snow Canyon (1♀, CAS; 2♀, 1♂, USU).

Specimens from Mexico, California, Idaho, Madera Canyon, Arizona, and Reno, Nevada, have silvery fasciate apically terga I–III, slightly infumate wings, and an impunctate pygidial plate of the female. A female from Bumble Bee, Arizona (UCD) and specimens from Snow Canyon, Utah, are similar, except for the silvery fasciate tergum IV. A female from Sycamore Canyon, Arizona (USU), and another one from Paradise Canyon, Utah (USU), have fasciate terga I–IV, weakly infumate wings, and their pygidial plate is punctate laterally. A female from Boyce Thompson Arboretum, Arizona (CAS) and one from Lagomarsino Canyon, Nevada (NSDA), have silvery fasciate apically terga I–IV, infumate wings, and an impunctate pygidial plate.

GEOGRAPHIC DISTRIBUTION (Fig. 78).—Idaho, Oregon, and Utah to Arizona, and Baja California Norte.

MATERIAL EXAMINED.—95♀, 159♂ (including 23♀, 37♂ paratypes).

RECORDS.—UNITED STATES: ARIZONA: **Cochise:** 2 mi W Portal, Southwestern Research Station (4 mi SW Portal). **Mohave:** Kingman. **Pima:** Madera Canyon in Santa Rita Mts. **Pinal:** Boyce Thompson Arboretum 3 mi W Superior. **Santa Cruz:** Sycamore Canyon. **Yavapai:** Bumble Bee. **County unknown:** Oak Creek Canyon. CALIFORNIA: **Alameda:** Arroyo Mocho. **Alpine:** Silver Creek. **Amador:** Volcano. **El Dorado:** Chili Bar. **Fresno. Humboldt:** 5 mi NW Garberville, Mad River Beach, Southern Fork of Eel River. **Inyo. Kern:** Antelope Canyon near Tehachapi, Mill Potrero, Rancheria Creek (Piute Mts.). **Lassen:** Hallelujah Junction. **Los Angeles. Madera:** Madera. **Mariposa:** Usona. **Mendocino:** 7 mi E Eel River Ranger Station, Mayacamas Mts., Robinson Creek (4 air mi SW Ukiah). **Mono. Monterey:** Arroyo Seco Camp, Monterey, Pacific Grove. **Nevada:** 10 air mi NNW Nevada City. **Riverside. San Benito:** Idria. **San Bernardino. San Diego. San Luis Obispo:** 4 mi SE Santa Margarita (also 6 mi NE). **Santa Barbara:** Bluff Camp (San Rafael Mts.), Los Prietos (also 4 mi E). **Santa Clara:** San Antonio Ranger Station. **Shasta:** Cassel, Hat Creek Post Office. **Sierra:** Sattley, Sierra Valley. **Siskiyou:** Upper Devils Peak. **Stanislaus:** Del Puerto Canyon. **Trinity:** Hayfork, Ruth. **Tulare:** California Hot Springs, Camp Wishon, Three Rivers. **Ventura:** Hungry Valley (5 mi S Gorman), Quatal Canyon (NW corner of county), Wagon Road No. 2 Campground (18 air mi WSW Gorman). IDAHO: **Gooding:** 1 mi NE Gooding. **Washington:** 32 mi W Indian Valley. NEVADA: **Storey:** Lagomarsino Canyon. **Washoe:** Reno. OREGON: **Wasco:** 5 mi S Dufur. UTAH: **Bonanza:** SW Bonanza. **Washington:** Paradise Canyon, Snow Canyon.

MEXICO: **Baja California Norte:** 3.9 mi S El Cóndor, Ensenada, Descanso, Santo Domingo area, 10 mi NW Santo Tomás. **Baja California Sur:** 3.5 km WNW San Isidro.

Tachysphex psammobius (Kohl)

(Figures 79, 80)

Tachytes psammobia Kohl, 1880:235, ♀, ♂ (incorrect original spelling). ! Lectotype: ♀, Italy: Bolzano (Naturhist. Mus. Vienna, Austria), designated by Pulawski 1971:189.—In *Tachysphex*: Kohl 1885:386, Pulawski 1971:189 (bibliography and summary of data on Palearctic populations); Bohart and Menke 1976:276; Kurczewski 1987:121.

Tachysphex asperatus W. Fox, 1894*a*:516, ♂. ! Holotype: ♂, Nevada: no specific locality (ANSP). Synonymized with *sculptilis* by Pulawski *in* Krombein 1979:1629.—Dalla Torre 1897:678, Ashmead 1899:250; Cresson 1928:43, G. Bohart 1951:950; Bohart and Menke 1976:272.

Tachysphex sculptilis W. Fox, 1894*a*:517, ♀. ! Holotype: ♀, Colorado: no specific locality (ANSP). **New synonym.**—Dalla Torre 1897:685, Cresson 1928:46, G. Bohart 1951:952, Bohart and Menke 1976:276; Krombein 1979:1629.

Tachysphex nigrescens Rohwer, 1908:220, ♂. ! Holotype: ♂, Colorado, Teller Co.

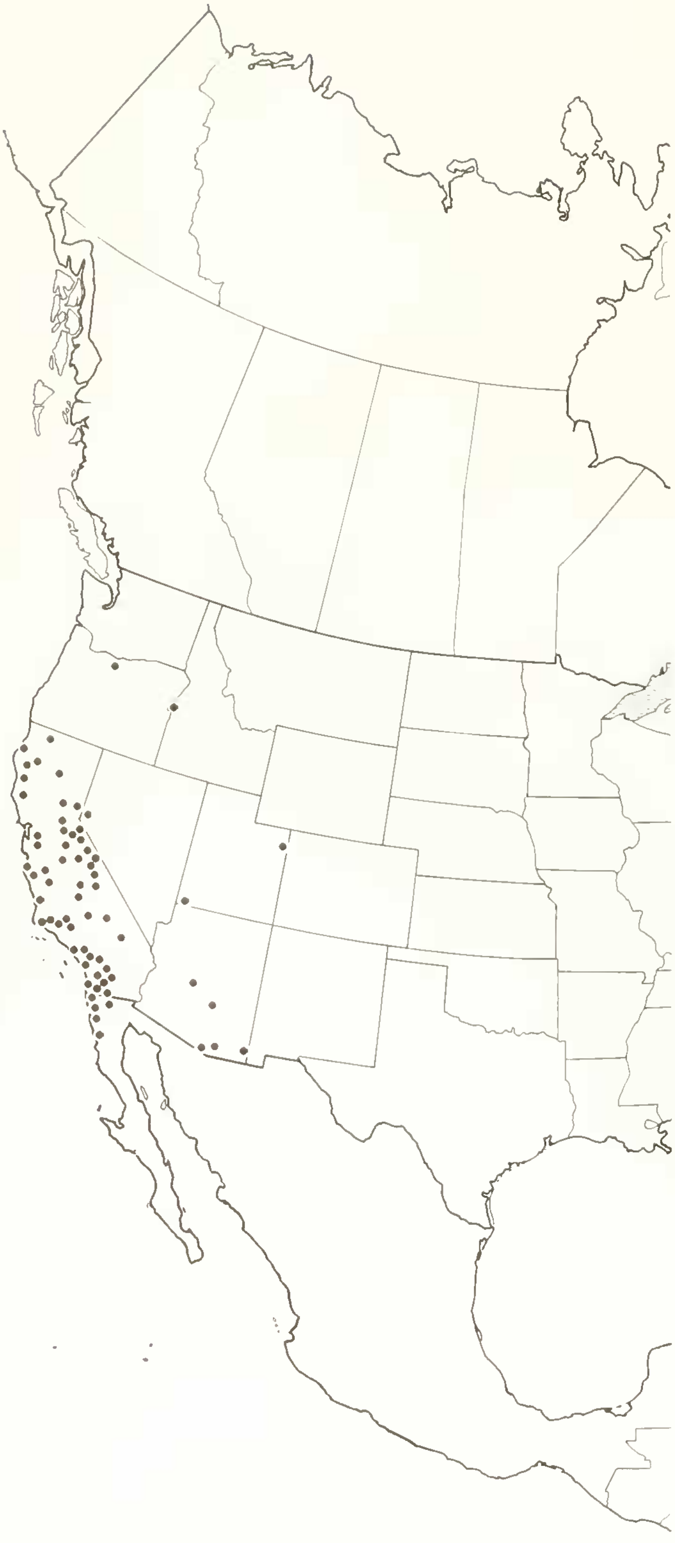

FIGURE 78. Geographic distribution of *Tachysphex hurdi* R. Bohart.

Florissant (USNM). Synonymized with *sculptilis* by Pulawski *in* Krombein 1979: 1629.—G. Bohart 1951:951, Bohart and Menke 1976:274.

Tachysphex sphecodoides Rohwer, 1911:578, ♀, ♂. Holotype: ♀, Colorado: Otero Co.: Rocky Ford (USNM). Synonymized with *sculptilis* by G. Bohart 1951:952.

DIAGNOSIS.—*Tachysphex psammobius* can be recognized by its small size (4.5–7.0 mm) combined with the punctate mesopleuron, midscutal setae oriented posterad or posterolaterad, presence of short, erect setae on the vertex and on the midfemoral venter apically (Fig. 79b); femoral setae suberect in male. The mesopleural punctures are ill defined in some males that can be recognized by the femoral setae character combined with the triangular clypeal lip (Fig. 79c), nondentate inner mandibular margin (Fig. 79c), nonvelvety sternal pubescence, and the rugose or ridged propodeal dorsum.

DESCRIPTION.—Frons, vertex, and mesothorax punctate; frontal and mesopleural punctures less than one diameter apart but mesopleural punctures often evanescent or more than one diameter apart posteriorly, ill defined in some males; interspaces dull or glossy. Propodeal dorsum irregularly rugose to longitudinally ridged; side ridged or (occasional specimens) ridges largely evanescent; hindface ridged, margined above. Discal micropunctures of tergum II two to several diameters apart. Sternum I without apical depression. Hindcoxa not carinate.

Vestiture not obscuring integument between antennal socket and orbit. Vertex setae erect, about 1.1–1.5 MOD long (but see also Variation below); midscutal setae oriented posterad.

Head, thorax, and legs black, tarsal apex brown. Gaster red to black. Wings faintly infumate. Frontal vestiture silvery.

♀.—Clypeus (Fig. 79a): bevel shorter to longer than basomedian area; lip arcuate or sinuate, not emarginate mesally or incised laterally. Dorsal length of flagellomere I 1.9–2.1 × apical width. Vertex width 1.5–1.6 × length. Punctures one to two diameters apart on vertex (rarely less), less than one diameter apart on scutum (rarely one or two diameters); minute on tergum V (apical depression impunctate). Pygidial plate alutaceous, sparsely punctate. Trochanteral and femoral punctation fine, dense, but trochanteral punctures sometimes evanescent. Length 6–7 mm.

Setae 0.3–0.4 MOD long on scutum, on midfemoral venter erect (Fig. 79b), about 1.0 MOD long distally (see also Variation below).

Terga I–IV silvery fasciate apically, fasciae usually weak.

♂.—Inner mandibular margin not dentate (Fig. 79c). Clypeus (Fig. 79c): bevel shorter than basomedian area, indistinctly delimited from the latter; lip obtusely triangular, its corners obtuse, indistinct, about as close to orbit as to each other. Dorsal length of flagellomere I 1.1–1.5 × apical width. Vertex width 1.6–2.2 × length. Punctures subcontiguous on scutum, about one diameter apart on vertex; minute on sterna (some of them more than one diameter apart); apical depression of sterna II and III partly impunctate in some specimens. Forefemoral notch glabrous or pruinose. Forebasitarsus usually without preapical rake spines, rarely with one or two spines (that are as long as width of basitarsus); outer apical spine of foretarsomere II about as long as tarsomere width. Length 4.5–6.3 mm.

Setae usually 0.5–0.6 MOD long on scutum, on midfemoral venter suberect, 0.3–0.8 MOD long on apical half (see also Variation below).

Terga I–V silvery fasciate apically.

VARIATION.—Body vestiture is longer in many specimens from southeastern Arizona, New Mexico, southwestern Texas (El Paso), and northwestern Texas (Turkey area) than it is in other individuals. For example, the vertex setae are (in MOD) 1.7

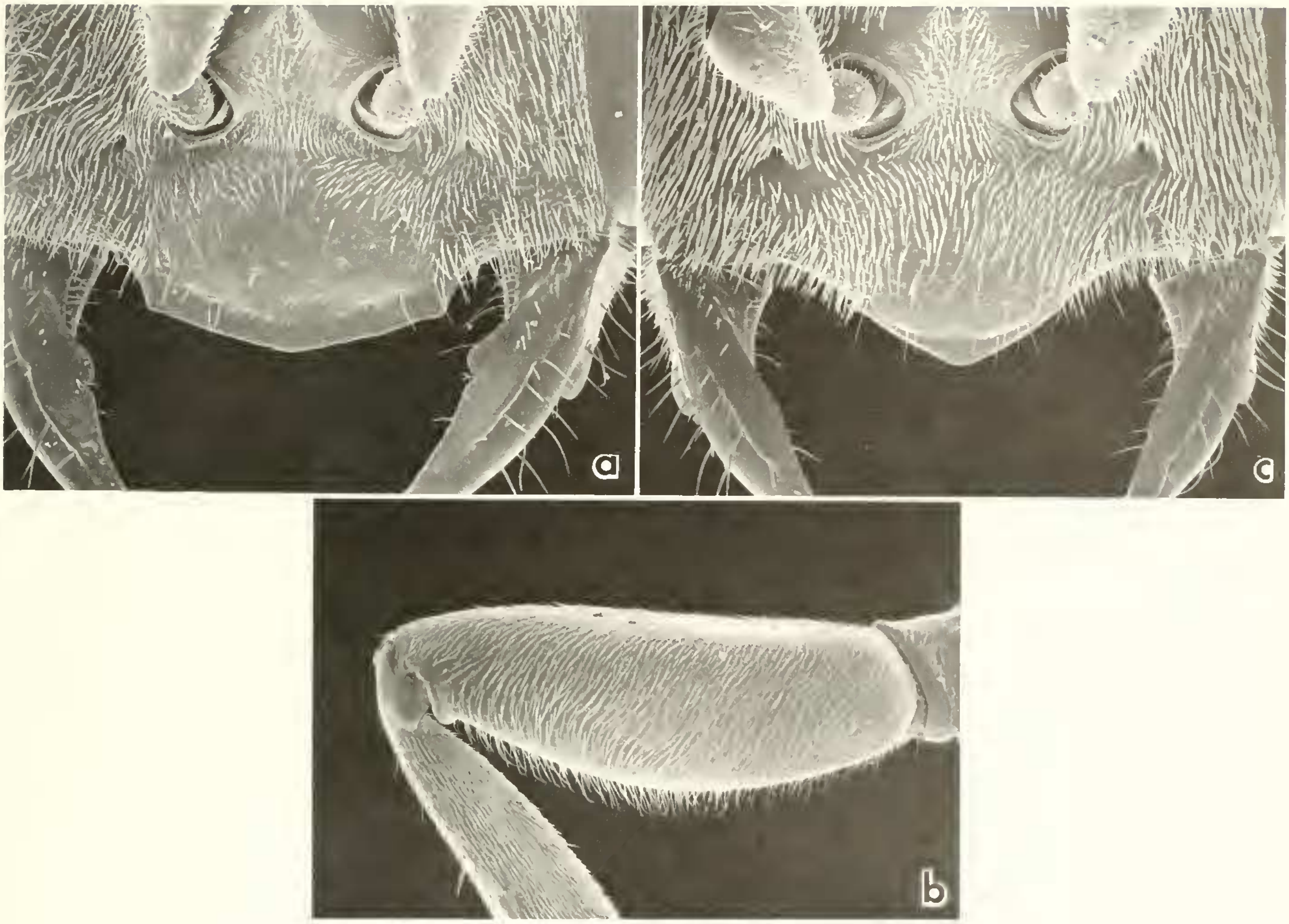

FIGURE 79. *Tachysphex psammobius* (Kohl): a—female clypeus; b—female midfemur; c—male clypeus.

long in a female from Picacho (MCZ) and 1.0 in one from Tucson (UCD), and the midfemoral setate are 1.3 long apicoventrally in two females from Willcox area (UCD) and in one from El Paso (UCD). The midfemoral setae are 1.0 MOD long in a male from Paradise Camp, California (UCD). Specimens with unusually long vestiture have a glossy mesopleuron.

In specimens from Valentine, Texas (1♀, 1♂, UCD), the mesopleural punctures are coarse, the interspaces are glossy, and the body vestiture is unusually long. The length of setae is 2.0 MOD on the vertex, on the scutum anteriorly, and on the mesopleuron, and 1.3–1.5 MOD on the midfemoral venter distally. In spite of these differences, I regard these individuals as *psammobius* rather than a distinct species.

LIFE HISTORY.—Nothing was known about the life history of *psammobius*, either in Europe or in North America, until Kurczewski (1987) observed a female near Manhattan, Kansas. Early instars of the grasshopper *Melanoplus*, either *differentialis* Thomas or *sanguinipes* (Fabricius), were used as prey and carried to the nest in flight. One prey was malaxated after stinging. During transport, the wasp clasped the grasshopper's body with all her legs and held the antennal bases with her mandibles. The wasp either took the prey directly into the nest or first dropped it at the entrance (she then entered the burrow, turned around inside, reappeared headfirst, and pulled the prey in). The description implies that the nest was permanently open during the provisioning period. She took an orientation flight after bringing in the first prey. Eleven prey were deposited in the cell, all head inward, nine venter up and two dorsum up. The egg was laid on the right forecoxal corium of the second largest prey and extended transversely between the fore- and midcoxae. The nest consisted of an oblique burrow and a single cell, with a tumulus near the entrance. After provisioning was completed, the wasps first used her forelegs in unison for closing the nest, and then packed the sand with the tip of her abdomen. Kurczewski (1987) also mentioned a female from Yuba Pass, California (UCD), pinned with her prey, a nymphal acridid *Aerochoreutes maculatus* (Scudder).

GEOGRAPHIC DISTRIBUTION (Fig. 80).—*Tachysphex psammobius* is a Holarctic nondesert species, although it occurs mainly in sandy habitats. In the New World, it ranges between British Columbia and western Texas, west to California, east to Nebraska and Colorado. In the Old World, it occurs in Europe.

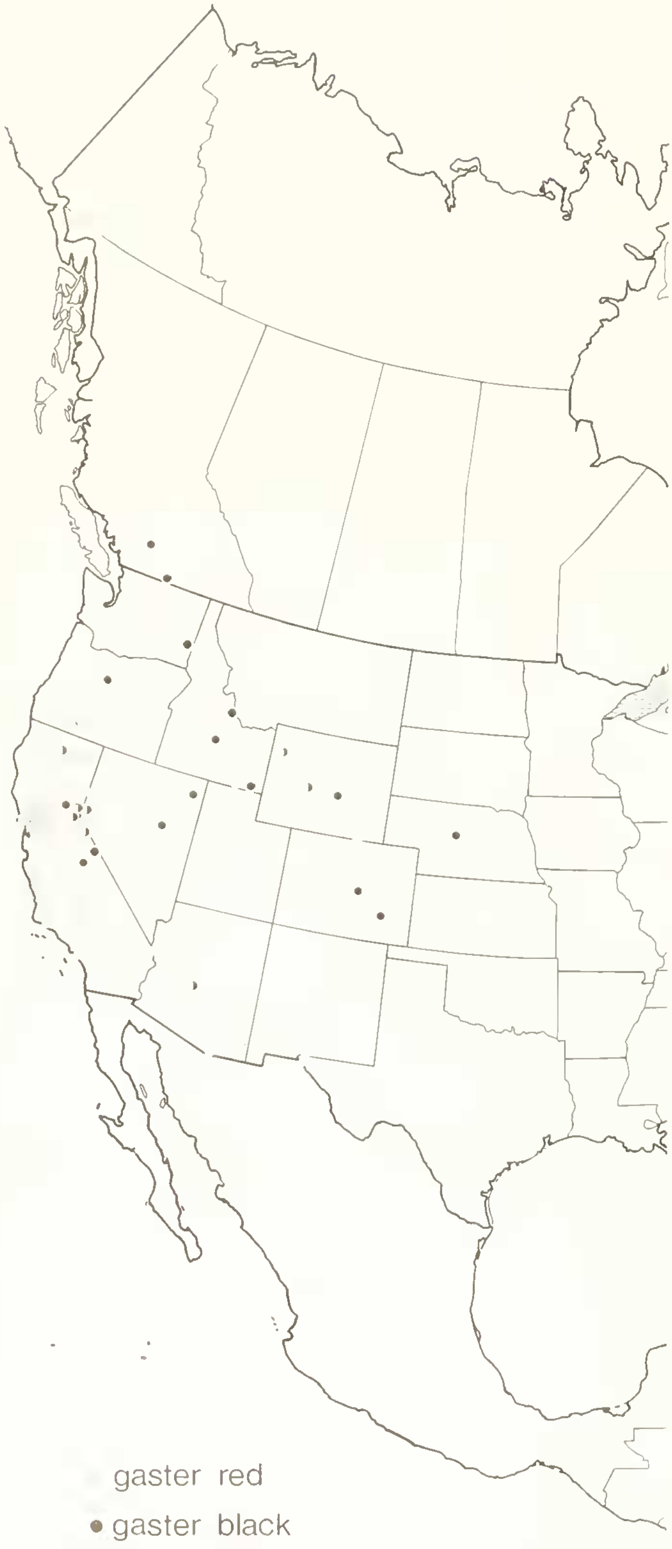

FIGURE 80. Geographic distribution of *Tachysphex psammobius* (Kohl) in North America

Cyprus, Turkey, Transcaucasia, Transcaspia, and in Siberia (Irkutsk area). It has not been found in the British Isles, Denmark, Fennoscandia, and Russia north of 59°N.

MATERIAL EXAMINED.—201♀, 133♂.

RECORDS (b: gaster black).—CANADA **British Columbia:** Oliver (b), Osoyoos (b), Skihist Camp on Fraser River (b)

UNITED STATES ARIZONA **Cochise:** Portal (also 3, 5, and 6 mi W, 3 mi SW, 3 mi E, 30 mi S). **Maricopa:** Rainbow Valley, route 74 5 mi W route 17 (partly b) **Pima:** Santa Catalina Mts., Tucson. **Pinal:** Picacho. **Santa Cruz:** Nogales, Tubac. CALIFORNIA: **Alameda. Alpine:** Hope Valley, Winnemucca, Woods Lake. **Colusa:** Walker Ridge (2 mi W Leesville). **Contra Costa. El Dorado. Fresno:** 1 mi E Frypan Meadow, Volcanic Lakes (b). **Humboldt:** 2 mi W Briceland, 3 mi N Garberville, Kneeland. **Inyo:** Grapevine Canyon (b). **Kern:** Glenville, 1 mi W Tehachapi. **Lassen:** 6 mi S Doyle. **Los Angeles:** 15 mi E Gorman, Tanbark Flat. **Marin:** Mt. Tamalpais State Park **Mariposa:** 1 mi E Jerseydale. **Modoc. Mono. Monterey:** Arroyo Seco, Bryson. **Napa:** Angwin. **Nevada:** Boca, Sagehen Creek near Hobart Mills (partly b). **Orange:** Trabuco Canyon. **Placer. Plumas:** Buck's Lake. **Riverside:** Sage. **Sacramento:** 10 mi NE Folsom. **San Benito:** 4 mi S Mercy Hot Springs (in Fresno Co.). **San Bernardino:** Mid Hills (9 mi SSE Cima), 1 mi W Needles. **San Diego:** Guatay. **San Luis Obispo:** Pozo (also 12 mi NE). **Santa Barbara:** Santa Ynez Mts. **Sierra:** Yuba Pass near Sierraville. **Siskiyou. Trinity:** Hayfork **Tulare:** Sequoia National Park, Visalia. **Tuolumne:** Buck Meadows, 3 mi W Sonora Pass (partly b). **Yolo:** Cache Creek Canyon, Davis. COLORADO. **Larimer:** Hewlett Gulch. **Las Animas:** —. **Otero:** Rocky Ford (b). **Teller:** Florissant (b). IDAHO **Blaine:** 5 mi N Chinook Mt. (b). **Custer:** 25 mi W Mackay. **Franklin:** Cub River Canyon (b). **Gooding:** 5 mi N Bliss, Hagerman Valley, Wood River 1 mi NE Gooding. **Lemhi:** 3 mi E Baker (b), Lemhi Pass (b). **Oneida:** Black Pine Canyon. **Owyhee:** Given Springs MONTANA **Sheridan:** Medicine Lake. NEBRASKA **Blaine:** Dunning (b). NEVADA **Elko:** Angel Lake in E Humboldt Range (b), Lamoille Canyon (Ruby Mts.). **Eureka:** Eureka. **Washoe:** Galena Creek, Mt. Rose summit (partly b). NEW MEXICO **Dona Ana:** 12 mi N Las Cruces. **Roosevelt:** Oasis State Park **Sierra:** Percha Dam State Park OREGON **Crook:** 9.5 mi N Post **Jackson:** 6 mi NW Medford **Jefferson:** Cove State Park (5 mi NW Culver—b) **Klamath:** above Algoma, Buck Lake Road 2.5 mi N Highway 66, 3 mi N Gearhart Mt., Klamath Falls. TEXAS. **El Paso:** El Paso. **Hall:** 6 mi SE Turkey **Jeff Davis:** Valentine UTAH **Beaver:** Beaver Canyon. **Box Elder:**—. **Cache:** Blacksmith Fork, Herd Hollow, Logan, Logan Canyon, Sardine Canyon. **Garfield:** Calf Creek **Juab:** Nephi. **Weber:** Willard Peak. WASHINGTON. **Whitman:** Pullman (b). WYOMING: **Fremont:** Lander (partly b). **Natrona:** Pathfinder Dam (8 air mi SW Alcova—b). **Teton:** 6 mi N Jackson, Moran (partly b).

Tachysphex glabrior Williams

(Figures 81, 82)

Tachysphex glabrior Williams, 1914:170. ♀, ♂. Holotype: ♀, Kansas: Phillips Co.: no specific locality (?KU, see Discussion below).—Mickel 1918:423, G. Bohart 1951:951, LaBerge 1956:527; Arnaud 1970:32; Bohart and Menke 1976:275 (incorrectly synonymized with *Tachysphex mundus* by R. Bohart); Krombein 1979:1628

DIAGNOSIS.—*Tachysphex glabrior* has a shiny, punctate mesopleuron, scutal setae are oriented uniformly posterad, and sternum I is not depressed apically. These traits are shared with some other species. Unlike *papago, psilocerus,* and *scopaeus,* terga I and II of *glabrior* are microsculptured throughout. Like *crenulatus* and *verticalis* (which have an impunctate mesopleuron), the clypeal lip of the female has two lateral incisions on each side (Fig. 81a); the presence of graduli on female sternum III is a subsidiary recognition feature. The male can be recognized by the presence of the graduli on sterna III–V (if sterna are fully extended); the combination of vertex setae that are 0.3–0.6 MOD long and of an arcuate or sinuate clypeal lip is also distinctive (vertex setae more than 1.0 MOD long in *hurdi* and *psammobius,* clypeal lip triangular in *psammobius*).

DESCRIPTION.—Frons shallowly, evenly punctate or (some males) microsculptured; punctures subcontiguous or (some specimens) several punctures before midocellus slightly more

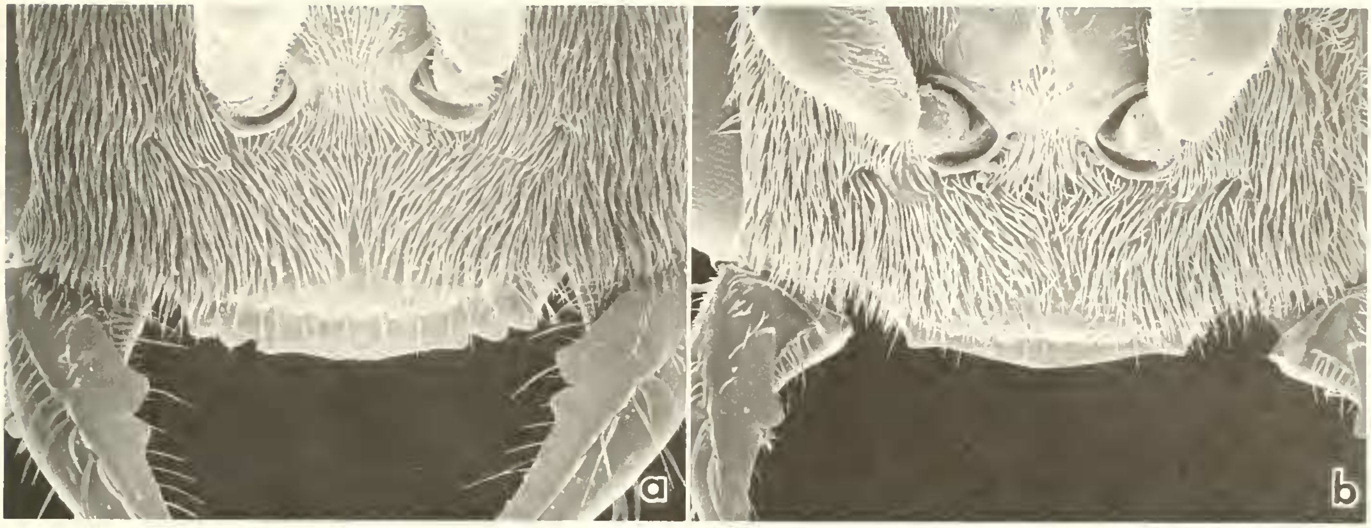

FIGURE 81. *Tachysphex glabrior* Williams: a—female clypeus; b—male clypeus.

than one diameter apart. Vertex evenly punctate, punctures less than one to about two diameters apart. Mesothorax shiny. Scutal punctures well defined, less than one diameter apart or (some specimens) a few discal punctures slightly more than one diameter apart. Mesopleural punctures fine, less than one diameter apart, but in most specimens two to three diameters apart posteriorly. Propodeal dorsum irregularly rugose or microreticulate; side and hindface ridged. Discal micropunctures of tergum II one to two diameters apart. Sternum I without apical depression. Hindcoxa carinate.

Vestiture almost totally hiding sculpture between antennal socket and orbit. Setae erect or suberect on vertex, 0.3–0.6 MOD long; subappressed on scutum and midfemoral venter, 0.3–0.5 MOD long; midscutal setae oriented posterad.

Body black with black tarsal apex or (some females) gastral segments I–III predominantly red. Wings weakly infumate to almost hyaline. Terga I–IV (I–V in many males) silvery fasciate apically. Frontal vestiture silvery.

♀.—Clypeus (Fig. 81a): bevel evenly swollen, equal to basomedian area or shorter; lip weakly arcuate to almost straight, with two lateral incisions on each side. Dorsal length of flagellomere I 1.5–1.7 × apical width. Vertex width 1.1–1.3 × length. Tergum V densely to sparsely punctate, apical depression impunctate. Pygidial plate punctate. Sternum III with graduli. Trochanters minutely, closely punctate. Forefemoral venter micropunctate, punctures one to three diameters apart. Length 6.5–7.5 mm.

♂.—Mandibular inner margin with tooth (Fig. 81b). Clypeus (Fig. 81b): bevel triangular, shorter than basomedian area; lip broadly arcuate or sinuate, weakly pointed mesally; its lateral corners distinct, obtuse; distance between corners about 1.25 of clypeal midline, and about 1.25 of distance between corner and orbit. Dorsal length of flagellomere I 1.0–1.25 × apical width. Vertex width 1.3–2.2 × length. Sterna densely punctate throughout, sterna III–V with graduli. Forefemoral notch finely pubescent. Foretarsus without rake; outer apical spine of tarsomere II much shorter than tarsomere III. Length 4.5–6.5 mm.

VARIATION.—The gaster is black in most specimens examined, but segments I–III are predominantly reddish in two of the six females examined from Bentsen Rio Grande Valley State Park, Texas (CAS). It is all red in a female from Cintalapa area, Mexico (UCD).

DISCUSSION.—The specimen of *glabrior* (KU) labeled holotype by F. X. Williams bears the label "Ness Co., Kansas." Phillips Co. was given as type locality in the original description, and there is a discrepancy in the collecting dates. Therefore, the presumed type may not be the true type. Possibly Williams (1914) gave the wrong type locality or the original labels were subsequently changed.

GEOGRAPHIC DISTRIBUTION (Fig. 82).—Kansas, Texas, Oklahoma, and southeastern Arizona to northwestern Venezuela.

MATERIAL EXAMINED.—58♀, 28♂ (CAS, CSU, CU, FSCA, KU, MCZ, KVK, UCD, UCR, UMMZ, USNM).

RECORDS.—UNITED STATES: ARIZONA: **Santa Cruz:** Santa Rita Mts. (1♀, KU). KANSAS: **Ellis, Ness:** —. Also Osborne, Phillips, Pratt, and Rush counties according to Williams (1914), but a male from the Rush Co. labeled as *glabrior* by him is actually *antennatus*. OKLAHOMA: **Comanche:** Wichita National Forest. TEXAS: **Bosque:** Meridian State Park. **Brazos:** —. **Brown:** Lake Brownwood State Park. **Cameron:** 13.4 and 15 mi E Brownsville. **Crockett:** Fort Lancaster State Historical Park. **Guadalupe:** Seguin. **Hidalgo:** Bentsen Rio Grande Valley State Park, McAllen Botanical Garden. **Kimble:** Junction. **Kleberg:** Baffin Bay 20 mi SE Kingsville. **Lee:** Fedor. **Palo Pinto:** Possum Kingdom State Park. **Somervell:** Dinosaur Valley State Park. **Travis:** Austin.

MEXICO: **Chiapas:** 25 mi W Cintalapa. **Jalisco:** Estanzuela (40 km W Ameca). **Morelos:** Cuernavaca (also 3 mi NW). **Nayarit:** Ixtlán del Rio. **Puebla:** Petlalcingo. **San Luis Potosi:** 5 mi N Ciudad del Maiz. **Sonora:** Alamos.

CENTRAL AMERICA: COSTA RICA: Bebedro and Rio Corbici near Cañas in Guanacaste Province. EL SALVADOR: Hacienda Capolinas (5 km NW Quezaltepeque), Quezaltepeque, San Salvador. HONDURAS: Zamorano.

VENEZUELA: **Aragua:** Lago de Valencia. **Zulia:** 31 km SW Machiques.

Tachysphex oasicola sp. n.

(Figures 82, 83)

DERIVATION OF NAME.—The name *oasicola* is derived form the Latin word oasis, and the suffix -cola, a dweller; a reference to Oasis State Park in New Mexico, where the holotype was collected.

DIAGNOSIS.—*Tachysphex oasicola* is characterized by a con-

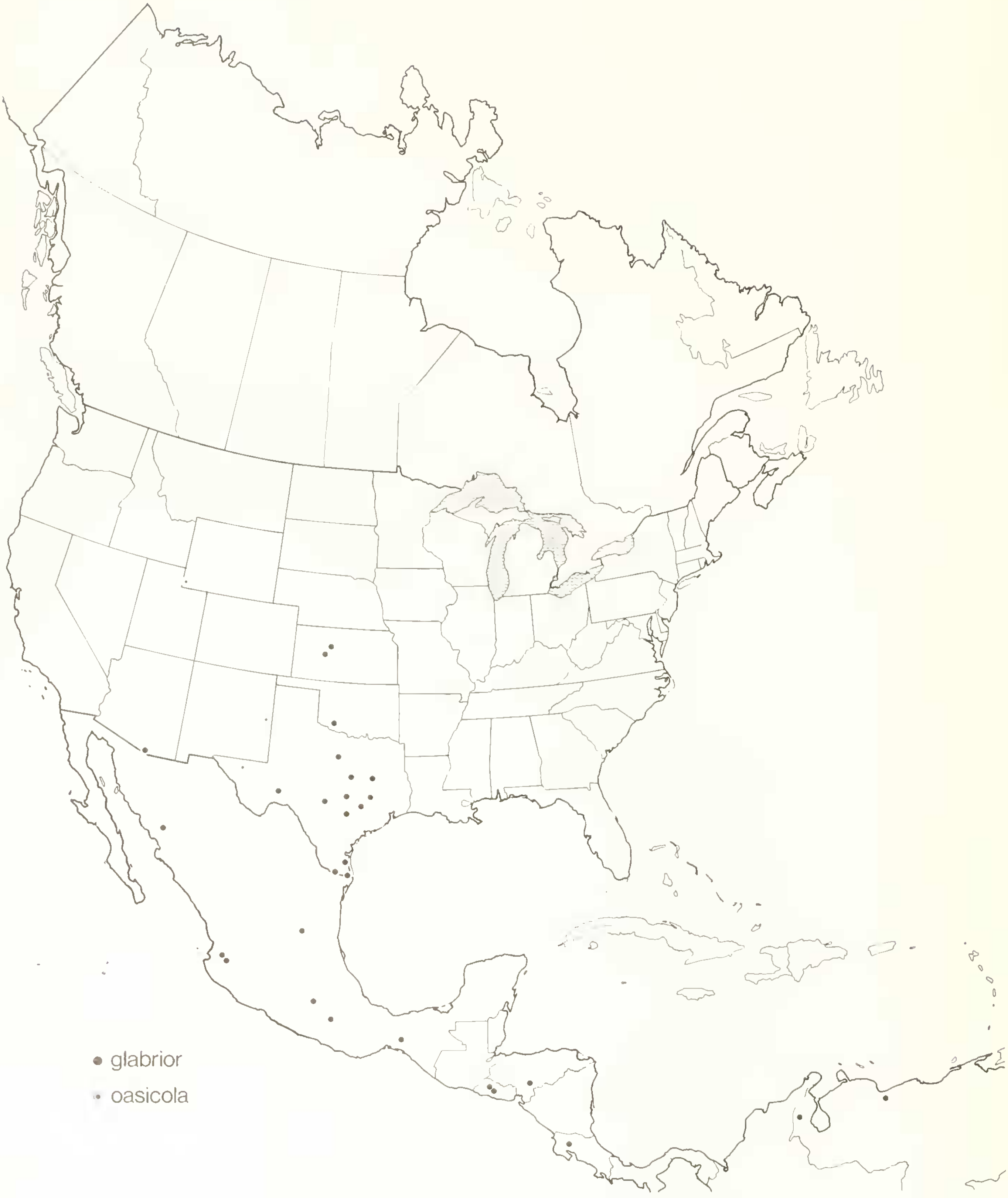

FIGURE 82. Geographic distribution of *Tachysphex glabrior* Williams and *oasicola* sp. n.

spicuously punctate mesopleuron and transversely oriented midscutal setae. *Tachysphex texanus* and its relatives have the same characters, but *oasicola* differs in having sternum I barely depressed apically. Helpful recognition features, although found in many other *Tachysphex*, are the sparsely punctate scutal disk (see Description below for details) and the red hindfemur (at least in the female). The sinuate clypeal lip of the female (Fig. 83a) is unique, and the shape of the male clypeus (Fig. 83b) is diagnostic in combination with the features mentioned above.

DESCRIPTION.—Punctures nearly contiguous on frons or (Texan females) more than one diameter apart; averaging several diameters apart on vertex except less than one diameter apart on postocellar impression; several to many diameters apart on scutal disk (except close to each other on area with transversely oriented setae); conspicuous and well defined on mesopleuron, averaging about two diameters apart beneath mesopleural scrobe; unevenly distributed on mesothoracic venter (less than one to more than two diameters apart). Propodeal dorsum irregularly microrugose, longitudinally ridged; side and hindface ridged; hindface ridges larger and farther apart than in other North American species. Sternum I with ill-defined apical depression. Discal punctures of tergum II a few diameters apart. Hindcoxa carinate basally.

Vestiture totally concealing sculpture between antennal socket and orbit as seen from many angles. Setae erect on vertex, slightly more than 1.0 MOD long; transversely oriented on midscutum; inclined on mesopleuron; appressed on midfemoral venter.

Head and thorax black, gaster red. Gastral terga I–III weakly fasciate apically, also tergum IV apicolaterally. Wings hyaline. Frontal vestiture silvery.

♀.—Clypeus (Fig. 83a): bevel about as long as basomedian area; lip weakly sinuate, not incised laterally. Dorsal length of flagellomere I 2.0× apical width. Vertex width 1.0–1.1 × length. Tergum V with a few, sparse punctures; apical depression impunctate. Pygidial plate alutaceous, sparsely punctate. Trochanters and femora finely, densely punctate. Length 9–10 mm.

Forefemur black, or red apically; midfemur black except reddish apically or (Texas females) also ventrally; hindfemur largely red (base and basodorsal third black), nearly all red in Texan females. Foretibia black, reddish on inner side; midtibia black except red on apical third, or red except black basally; hindtibia red except black at its very base. Tarsi red.

♂.—Mandibular inner margin with tooth. Clypeus (Fig. 83b): bevel shorter than basomedian area; lip sinuate, its base straight, its lateral corner well defined; distance between corners equal to 0.7 of clypeal length and of distance between a corner and orbit. Dorsal length of flagellomere I 1.6× apical width. Vertex width 1.4× length. Sterna punctate, except impunctate apical depressions of sterna II–V. Forefemoral notch pruinose. Forebasitarsus with one to three preapical rake spines. Outer apical spine of foretarsomere II shorter than tarsomere width. Length 6.5–7.5 mm.

Fore- and midfemora black; hindfemur largely red (black on basodorsal half) in holotype, black except red on apical third in paratype. Foretibia black, red on inner side; midtibia largely black with variable amount of red; hindtibia largely red (black basally) in holotype, black with small red areas apically in paratype. Tarsi red.

GEOGRAPHIC DISTRIBUTION (Fig. 82).—Western Texas, New Mexico, Wyoming.

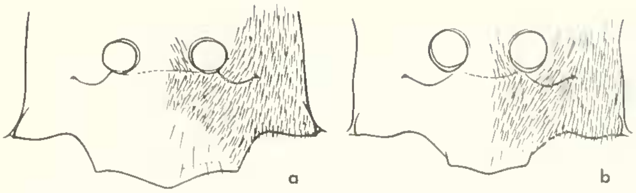

FIGURE 83. *Tachysphex oasicola* sp. n.: a—female clypeus; b—male clypeus.

MATERIAL EXAMINED.—Holotype: ♂, New Mexico, Roosevelt Co.: Oasis State Park, 21 May 1985, WJP (CAS, Type #15904).

Paratypes (3♀, 1♂): UNITED STATES. NEW MEXICO: **Roosevelt:** 1♂, same data as holotype. TEXAS: **Culberson:** 60 mi N Van Horn, 9 Apr 1986, TLG (2♀, CAS, USU). WYOMING: **Uinta:** Evanston, 4 Sept 1966, A. Wilkins (1♀, CAS).

Tachysphex amplus W. Fox

(Figures 84, 85)

Tachysphex amplus W. Fox, 1894*a*:522, ♀, ♂. ! Lectotype: ♀, Nevada: no specific locality (ANSP), designated by Cresson 1928:43.—Dalla Torre 1897:678; Ashmead 1899:250; Cockerell 1900:143; G. Bohart 1951:950, Krombein 1967:392; Bohart and Menke 1976:272; Krombein 1979:1627, Rust et al. 1985:46.

Tachysphex gillettei Rohwer, 1911:571, ♀. ! Holotype: ♀, Colorado: Rocky Ford (USNM). Synonymized by G. Bohart 1951:950.

Tachysphex neomexicanus Rohwer, 1911:575, ♀. ! Holotype: ♀, New Mexico: Rio Ruidoso in White Mts. (USNM). Synonymized by G. Bohart 1951:950.

DIAGNOSIS.—*Tachysphex amplus* has a punctate mesopleuron and transversely oriented midscutal setae. Several other species share these characters, but they have a horizontal depression at the apex of sternum I, while *amplus* has a triangular, gradually sloping surface (Fig. 84b), which in most specimens is slightly concave. The shape of the clypeal lip in both sexes (Fig. 84a, c) and the long male flagellomere I (dorsal length 1.7–2.0× apical width; Fig. 84d), are also distinctive. Subsidiary diagnostic features are: body large (female: 11–13 mm, male: 8.5–10.0 mm), and male sterna with velvety pubescence.

DESCRIPTION (see also Table 2 under *texanus*, p. 123).—Punctures less than one to slightly more than one diameter apart on vertex; on scutum mainly subcontiguous, but up to three diameters apart on disk in some specimens. Mesopleural punctures 0.3–2.0 diameters apart below scrobe. Propodeal dorsum coarsely rugose, not ridged, or (some specimens) microareolate or very densely punctate. Discal micropunctures of tergum II two to five diameters apart.

Vertex setae about 1.0 MOD long.

Legs in most specimens black (except tarsal apex reddish), but part of hindfemur or all femora and part of hindtibia red in occasional Arizona and California females. Gaster red, rarely male segments V–VII brown. Terga I–III or I–V silvery fasciate apically, fascia interrupted mesally. Wings almost hyaline.

♀.—Clypeus (Fig. 84a): bevel about as long as basomedian area; lip arcuate, narrow or (some specimens) broadened mesally. Dorsal length of flagellomere I 2.2–2.5× apical width. Vertex width slightly more to slightly less than length. Tergum V sparsely punctate. Length 11–13 mm.

Vestiture not obscuring integument between antennal socket and orbit. Scutal setae appressed or suberect, shorter than MOD.

♂.—Clypeus (Fig. 84c): lip straight to arcuate, its corners distinct, closer to each other than to orbits (markedly so in some specimens) or equidistant; short, longitudinal carina extending from each lip corner. Dorsal length of flagellomere I (Fig. 84d) 1.7–2.0× apical width. Vertex width 1.3–1.5× length. Tergum

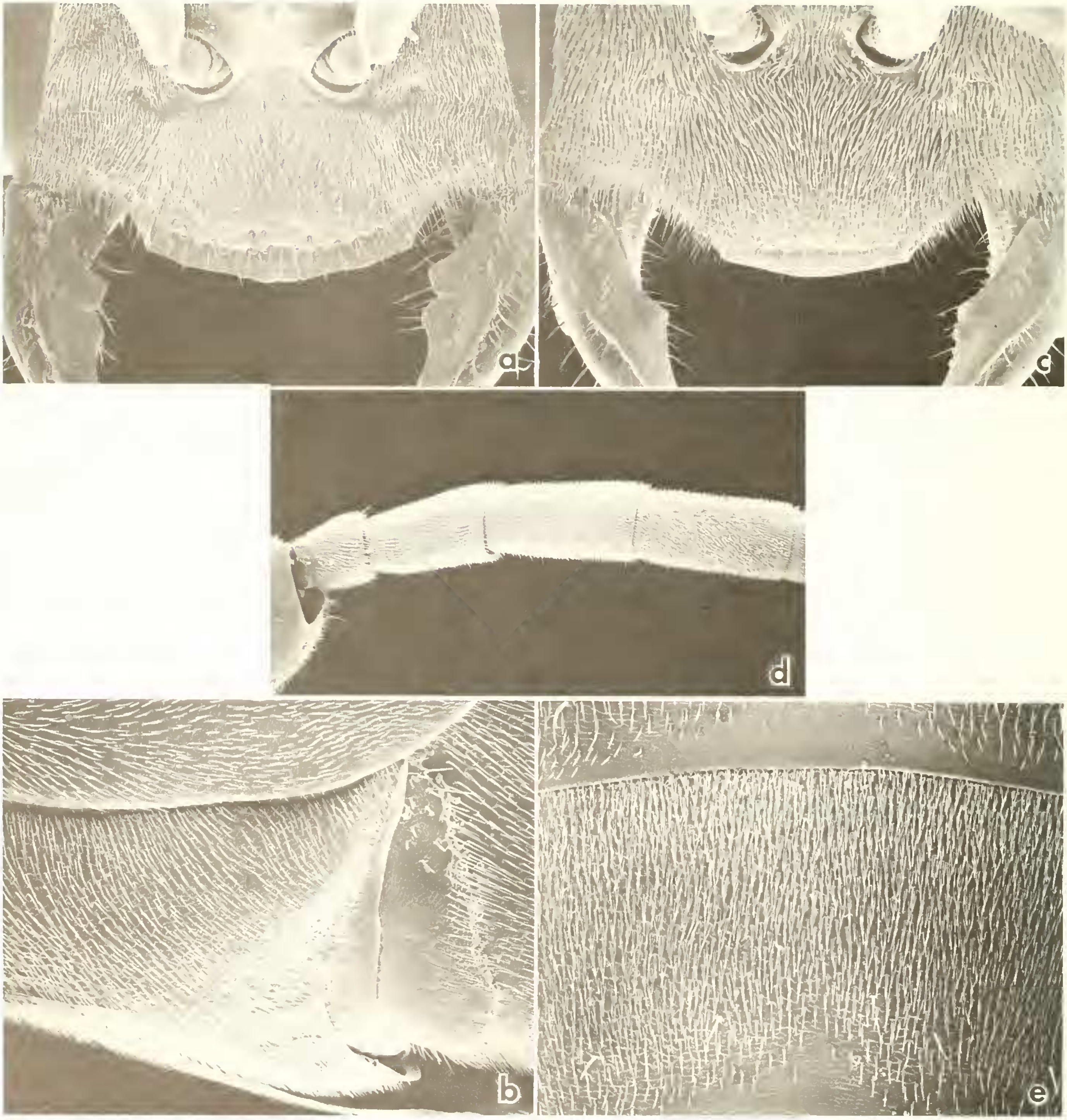

FIGURE 84. *Tachysphex amplus* W. Fox. a—female clypeus, b—female sternum I obliquely, c—male clypeus, d—basal flagellomeres of male, e—vestiture of male sternum III.

VII densely punctate except basal punctures sometimes more than one diameter apart. Sterna II–VII evenly, minutely punctate (punctures less than one diameter apart), except for smooth, impunctate apical depression. Length 8.5–11.0 mm.

Vestiture obscuring integument between antennal socket and orbit (except when viewed from certain angles). Scutal setae subappressed, about 1.0 MOD long. Sternal pubescence velvety, almost concealing integument (Fig. 84e).

GEOGRAPHIC DISTRIBUTION (Fig. 85).—United States and Mexico west of 100th meridian, north to southern Alberta.

MATERIAL EXAMINED.—255♀, 439♂.
RECORDS.—CANADA. **Alberta:** Pakowki Lake

UNITED STATES: ARIZONA: **Apache:** Canyon de Chelly, 10 mi W Springerville. **Cochise. Coconino:** Flagstaff, 6,700 ft. **Maricopa:** Wickenburg. **Mohave:** 9 mi E Oatman, Peach Springs. **Navajo:** Jadito Trade Post. **Pima:** 12 mi W Tucson. **Pinal:** Casa Grande. **Santa Cruz:** Canelo, Madera Canyon (Santa Rita Mts.), Sonoita. **Yavapai:** Oak Creek near Cornville. CALIFORNIA: **Alameda:** Livermore, Sycamore Grove State Park. **Alpine:** 3 mi NE Woodfords. **Colusa:** Little Stony Creek. **Contra Costa:** Antioch, Mount Diablo, 5 mi SE Walnut Creek. **El Dorado:** 10 mi N on Ice House Road. **Fresno. Glenn:** Artois. **Humboldt:** 4 mi E Alderpoint. **Inyo. Kern. Lake:** Lake Pillsbury, Middletown. **Lassen:** Constantia, Hallelujah Junction. Hot Spring Mountain. **Los Angeles. Marin:** Larkspur (Baltimore Park). **Mariposa:** Yosemite Valley. **Mendocino:** Hopland Field Station, Robinson Creek (4 air mi SW Ukiah). **Modoc:** Alturas. **Mono. Monterey. Napa:** 5.5 km NW Moscowite Corner (Capell Creek), Napa. **Orange:** Corona del Mar, Laguna Beach. **Placer:** Auburn. Roseville. **Riverside:** 16 mi N Blythe, Deep Canyon, Riverside. **Sacramento:** Folsom. **San Benito:** 5–10 mi N Idria (Gem Mine). **San Bernardino. San Diego. San Luis Obispo. Santa Barbara:** 3 mi W Cachuma Lake, Santa Cruz Island, 2 mi E Solvang. **Santa Clara:** San Antonio Valley, San Jose. **Shasta:** Redding, 3 mi S Round Mountain. **Siskiyou:** Klamath River 8 mi N Yreka, Lava Beds National Monument (S edge), Sheepy Peak (5 mi W Tulelake). **Solano:** Green Valley (W Fairfield). **Trinity:** Junction City, 13 mi SE Zenia. **Tulare:** Three Rivers. **Tuolumne. Ventura. Yolo:** Davis, Monticello Dam. COLORADO: **Arapahoe:** Littleton. **Bent:** 2 mi S Hasty, 23 mi S Las Animas. **Boulder:** Lyons Quarry, Marshall, White Rocks (5 mi E Boulder). **Jefferson:** Clear Creek. **Larimer:** Fort Collins. **Mesa:** Colorado National Monument. **Otero:** Rocky Ford. **Weld:** Nunn, Pawnee National Grassland. IDAHO: **Butte:** 6 mi S Howe. **Elmore:** 3 mi W Hammett, 13 mi S Sunnyside. **Gooding:** 3 mi S Gooding. **Owyhee.** KANSAS: **Logan, Scott, Stanton:** —. MONTANA: **Beaverhead:** 5 mi W Dillon. NEVADA: **Clark:** W Juanita Springs (10 mi S Riverside), 14 mi SW Mesquite, 7 mi NW Moapa. **Douglas:** 3 mi S Genoa, Topaz Lake. **Elko:** 7 mi E Carlin. **Esmeralda:** 15 mi S Goldfield. **Eureka:** 19 mi N Eureka. **Lincoln:** Garden Wash (ca. 12 mi E Carp). **Lyon:** Dayton. **Mineral:** 5 mi NW Schurz. **Storey:** Lagomarsino Canyon. **Washoe.** NEW MEXICO: **Bernalillo:** Albuquerque. **Guadalupe:** Santa Rosa. **Lincoln:** Rio Ruidoso in White Mts. **Otero:** Alamogordo. **Roosevelt:** Milnesand. **Socorro:** 14 mi W Magdalena. OREGON: **Jackson:** Gold Hill. **Klamath:** Klamath Falls, Sprague River Campground. **Malheur:** 50 mi W Jordan Valley. TEXAS: **Brewster:** 9 mi S Alpine. **Ector:** Odessa. **Jeff Davis:** Davis Mts., 10 mi NW Fort Davis, Musquiz Canyon near Mitre Peak. UTAH: **Box Elder:** Brigham City. **Emery:** 9 air mi E Castle Dale, 15 mi NW Woodside. **Garfield:** Capitol Reef National Park. **Grand:** Crescent Junction, Salt Valley (NW Arches National Park). **Kane:** Kanab. **Millard:** 12 mi NW Fillmore. **San Juan:** Kane Springs (E Natural Bridges National Monument). **Uintah:** SW Bonanza, Ouray Valley. **Washington:** 1 mi W Leeds, Snow Canyon. WASHINGTON: **Kittitas:** Whiskey Dick Canyon (8 mi N Vantage). WYOMING: **Converse:** Glenrock. **Niobrara:** northern part. **Platte:** —.

MEXICO: **Baja California Norte:** El Rosarito (114°W), 6 mi NE Santa Rosalillita (28°45′N, 114°10′W). **Baja California Sur:** El Pescadero. Los Angeles (Rancho), Los Barriles, 4 mi WSW Miraflores, Playa San Cristóbal. **Sinaloa:** 80 km E Mazatlán. **Sonora:** Guaymas. **Zacatecas:** 9 mi N Ojocaliente.

Tachysphex yolo Pulawski

(Figures 86, 87)

Tachysphex yolo Pulawski, 1982:37, ♀, ♂. ! Holotype: ♂, California: Yolo Co.: Davis (UCD).—Elliott and Kurczewski 1985:294, Kurczewski 1987:119.

Diagnosis.—*Tachysphex yolo* has transversely oriented midscutal setae, a horizontal depression at apex of sternum I, and a punctate mesopleuron (punctures indistinct in some individuals). Other species share this combination of characters, but the female of *yolo* has a distinctive clypeus and sternum II: the dense clypeal punctation reaches the lip base laterally (Fig. 86a, b) so that the sparsely punctate, apical area does not extend laterad to the lip corner level (its width is about 0.5–0.8 of the lip foremargin); and in most specimens there is no micropunctation along midline of sternum II from the base (or nearly so) to apex. In other species, the dense punctation of the clypeus does not reach the lip base (the sparsely punctate, apical area is as wide as the lip or nearly so), and the micropunctation of sternum II in most specimens is absent only from an apicomedian, triangular area. The male resembles *lamellatus* and *sonorensis* in having nonvelvety sternal pubescence, but unlike these species its clypeal lip (Fig. 86c–e) is not triangular. Unlike most *lamellatus*, the hypostomal carina of *yolo* is not lamelliform, and unlike the male of *sonorensis*, flagellomeres III and IV are about equal in length. Subsidiary recognition features

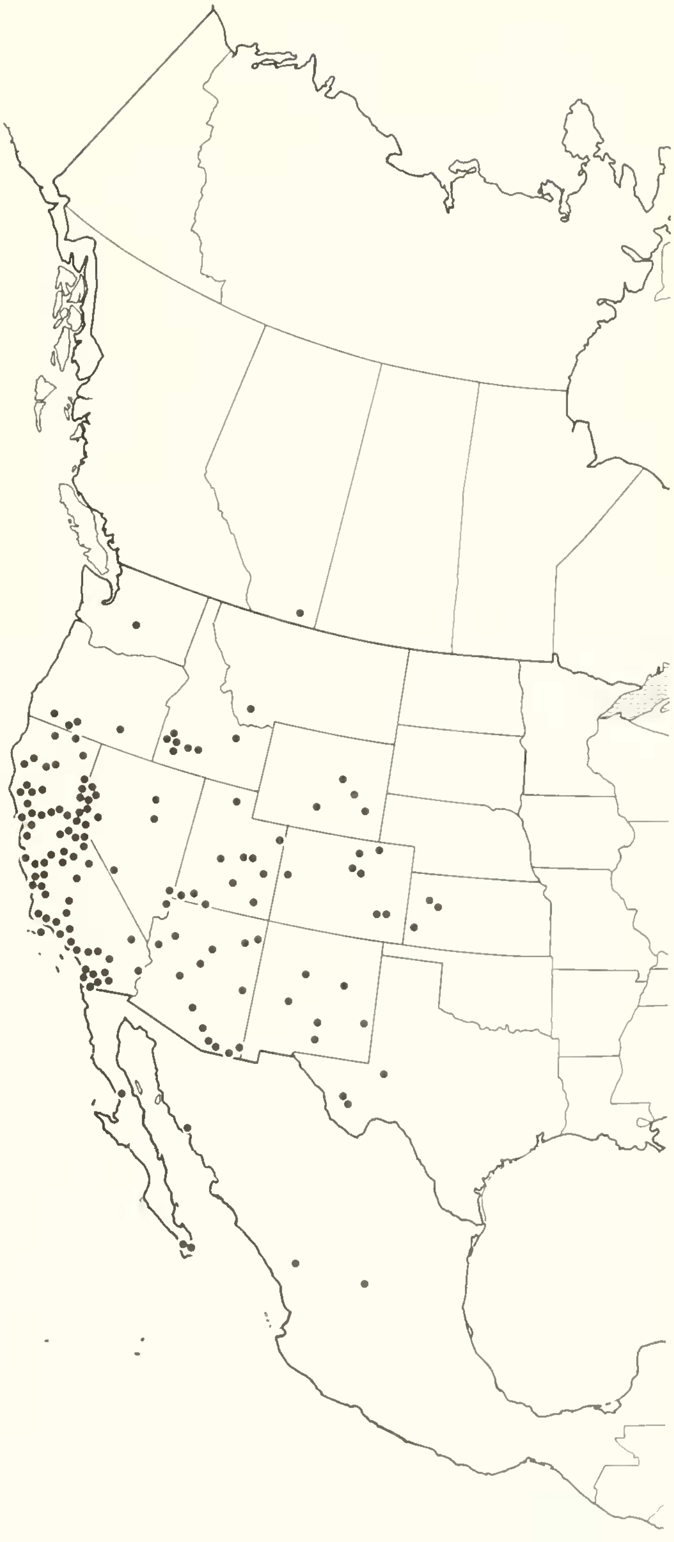

Figure 85. Geographic distribution of *Tachysphex amplus* W. Fox.

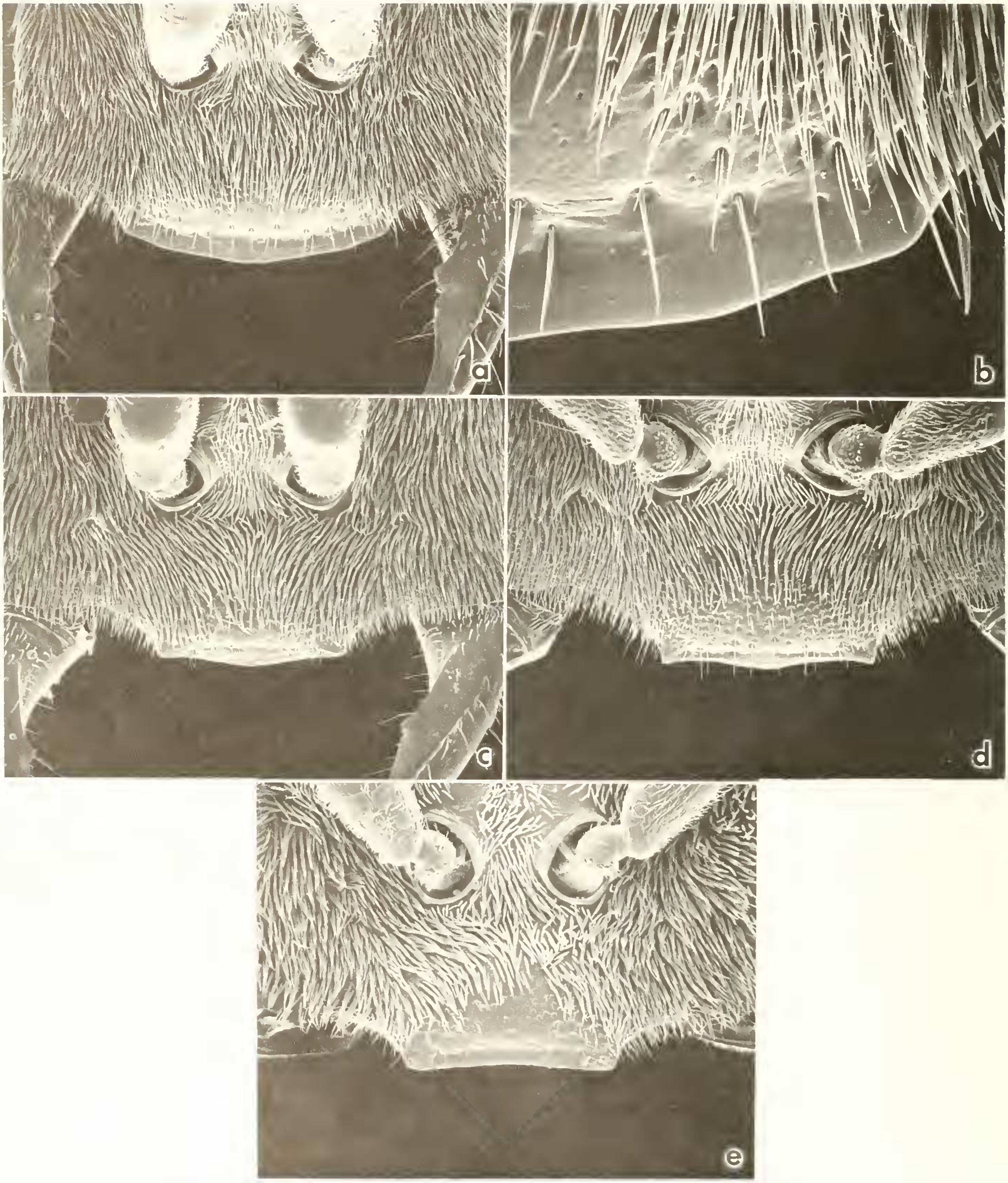

FIGURE 86. *Tachysphex yolo* Pulawski. a—female clypeus, b—anterolateral portion of female clypeus; c–e—male clypeus.

are: mesopleural punctures subcontiguous, ridges of propodeal side evanescent in many specimens, and foretarsal rake present in many males.

Description (see also Table 2 under *texanus*, p. 123).—Punctures subcontiguous on mesopleuron (evanescent in some specimens); up to two or three diameters apart on vertex; less than one diameter apart on scutum or (some females) a few punctures two to three diameters apart. Propodeal dorsum evenly areolate or finely rugose; side ridged but ridges evanescent in many specimens.

Setae about 1.0 MOD long on vertex; appressed or nearly so on mesopleuron except subappressed to suberect on hypoepimeral area; midscutal setae in some desert specimens forming a rosettelike pattern: setae near pronotum directed anterad.

Legs black, tarsal apex reddish, but hindfemur and hindtibia partly red in two females from Paradise Canyon, Utah (CAS, USU), and entirely red in another female from the same locality (USU), in a female from Blythe, California (UCD), and in three females from Rainbow Valley, Arizona (CAS, UAT). Gaster red or (some males from Davis, California) terga IV–VII dark brown. Terga I–IV silvery fasciate apically. Wings hyaline or nearly so.

♀.—Clypeus (Fig. 86a, b): bevel varying from markedly shorter than basomedian area to (some specimens) as long as the latter, not extending laterad to lip corner (equal to 0.5–0.8 of lip free margin); lip arcuate. Dorsal length of flagellomere I 2.0–2.4 × apical width. Vertex width : length ratio: 0.9–1.1. Discal micropunctures of tergum II one to two diameters apart. Punctation of tergum V sparse or (some specimens) dense laterally. Length 7.5–10.0 mm.

♂.—Mandibular inner margin and clypeal lip varying (see Variation below). distance between lip corners slightly more to slightly less than distance between corner and orbit. Dorsal length of flagellomere I 1.2–1.5 × apical width. Vertex width 1.3–1.5 × length. Sterna minutely, densely punctate except sternum II narrowly impunctate at apex. Outer margin of forebasitarsus with none to four preapical spines whose maximum length may attain 1.5 × width of basitarsus; outer apical spine of foretarsomere II much shorter to slightly longer than foretarsomere III. Length 5.5–6.5 mm.

Sternal pubescence not velvety, integument easily visible.

Variation.—The vestiture and male clypeus vary considerably in specimens from various localities. The greatest differences are between individuals from desert and nondesert habitats, as described below.

Vestiture. In specimens from nondesert habitats (e.g., Davis, California), the integument is not totally obscured by vestiture between the antennal socket and orbit; it is easily visible on the mesopleuron. In specimens from deserts (e.g., Borrego Valley, California), the sculpture is totally concealed between the antennal socket and orbit, and partly so on the mesopleuron. Specimens from many localities are intermediate.

Clypeal lip of male (Fig. 86c–e). It can be: (a) slightly sinuate, (b) slightly arcuate, (c) straight, or (d) with foremargin slightly concave. These conditions are not sharply delimited, and intermediates exist. Type a occurs mainly in nondesert habitats, and type d only in deserts. More than one type can be found in most localities, and all four have been collected at Lone Pine, California.

Mandible of male. The inner mandibular margin of most specimens has a widely obtuse tooth (Fig. 86e). The tooth is sharp in two males from the Providence Mountains State Park, California (CAS), in which the clypeus is of type d.

Life History.—A female of this species (UCD) was collected on flowers of *Chrysothamnus nauseosus* (Pall.) Britton at Newcomb, New Mexico. A paratype female from St. Anthony, Idaho, was collected while walking on the ground with a small nymph of *Melanoplus foedus* Scudder (Elliott and Kurczewski 1985). A female from Eureka area, Utah, is pinned with a juvenile *Melanoplus* sp. (Kurczewski 1987).

Geographic Distribution (Fig. 87).—West Coast to southern Texas, north to Oregon, south to Baja California and Sinaloa, Mexico.

Material Examined.—543♀, 662♂

Records.—UNITED STATES. ARIZONA **Cochise:** Bowie, Willcox (also 1 and 3.5 mi S, 2 mi E). **Coconino. Graham:** Roper Lake State Park (6 mi S Safford). S side of San Carlos reservoir. **Maricopa. Mohave. Navajo:** Jadito Trade Post. **Pima:** 18 mi W Sells. Tucson. **Pinal. Santa Cruz:** Tumacacori Mts. **Yavapai:** 8 mi N Aguila **Yuma.** CALIFORNIA. **Alameda:** Arroyo Valle. **Colusa:** 2 mi E Colusa. **El Dorado:** Chili Bar. **Fresno:** 25 mi E Fresno. Jacalitos Canyon. **Humboldt:** Garberville. **Imperial. Inyo. Kern:** Johannesburg. Kernville. **Lake:** Northern Fork of Cache Creek at Highway 20. **Lassen:** Hallelujah Junction. **Los Angeles. Mendocino. Mono:** Benton Inspection Station, Paradise Camp. **Monterey:** Fort Ord. Monterey. Soledad. **Modoc:** Adin Pass, Fandango Pass. **Placer:** Emigrant Gap. **Plumas:** Chilcoot. Halstead Campground (E branch North Fork Feather River). **Riverside. Sacramento:** Grand Island. Sacramento. Sacramento River Levee. **San Benito:** Pinnacles National Monument. **San Bernardino. San Diego. San Joaquin:** 8 and 10 mi SW Tracy. **San Luis Obispo:** Black Lake Canyon, 10 mi W Simmler. **San Mateo:** 10 mi SW San Francisco. **Santa Barbara:** 3 mi W Cachuma Lake, Los Prietos. 2 mi E Solvang. **Santa Clara:** San Jose. **Shasta:** Old Station. **Sierra:** 6 mi E Downieville **Siskiyou:** Dorris, Hawkinsville–Lona Gulch, Klamath River 8 mi N Eureka. Swallows (13 mi N Yreka). **Sutter:** Nicolaus. **Trinity:** Hayfork Agricultural Station. Junction City. **Tuolumne:** Hetch Hetchy Dam. **Ventura. Yolo. Yuba:** 18 mi NE Marysville. COLORADO: **Weld:** Roggen. IDAHO **Franklin:** Preston. **Fremont:** St. Anthony Sand Dunes. **Lincoln:** 6 mi NE Shosone. NEVADA: **Churchill. Clark. Esmeralda:** 7 mi N Dyer. 15 mi W Tonopah. **Humboldt:** 10 mi N Winnemucca. **Lyon:** Weeks. **Mineral:** Luning, 3 mi SE Schurz (also 4 5 mi S). Teels Marsh Sand. **Nye:** 4 mi S Warm Springs (also 13 mi W). **Pershing:** Woolsey. **Washoe.** NEW MEXICO: **De Baca:** Sumner Lake State Park. **Dona Ana:** Las Cruces. Leesburg Dam State Park. 4 mi E Mesilla Park **Hidalgo:** 14 mi N Animas. **Lincoln:** Devil's Canyon (20 mi NE Ruidoso). 5 mi S Oscura. **Luna:** Columbus. **Otero:** Alamogordo. White Sands National Monument. **San Juan:** Newcomb. **Socorro:** 1 mi SW Bernardo Sevilletta National Wildlife Refuge. La Joya (20 mi N Socorro), 22 mi S Socorro. **Valencia:** Acoma Pueblo. OREGON: **Deschutes:** Smith Rock State Park. **Josephine:** 8 mi W Grants Pass. **Klamath:** Bonanza. **Morrow:** Boardman **Umatilla:** Hat Rock State Park. TEXAS. **Brewster:** 2 mi E Study Butte. **Duval:** 18 mi N San Diego. **Hidalgo:** Bentsen Rio Grande Valley State Park, Santa Ana Wildlife Refuge **Hudspeth:** McNary, Sierra Blanca. **Jim Wells:** Palito Blanco. **Presidio:** 5 mi E Presidio. **Ward:** 6 mi E Monahans. **Webb:** 9 mi SSE Laredo. UTAH **Cache:** Cornish. **Emery. Garfield:** Bullfrog Creek area near Lake Powell. **Grand:** Crescent Junction, Moab. **Juab:** 12 mi S Eureka. White Sands Dunes (25 mi SW Eureka) **Millard:** 15 mi N Delta, Pahvant (near Flowell). **San Juan:** 6 mi S La Sal Junction. **Washington:** Leeds Canyon, Paradise Canyon. **Wayne:** 8 mi N Hanksville.

MEXICO **Baja California Norte:** 4 mi N Bahia de los Angeles. 10 mi E Bahia San Quintin. Cataviña. 9 mi SW Colonet, Descanso. El Crucero. El Portezuelo (39 road mi S Cataviña). 25 km SE Laguna Chapala. 20 mi N Mesquital. El Progreso (Sierra Juárez). 3 mi NE Mission San Borja. 38 km S Rosarito (114°W). 3 mi N San Felipe. San Quintin (also 10 and 40 mi S), San Vicente, 1–3 mi SE Santa Rosalillita (28°44′N, 114°08′W). **Baja California Sur:** 12 mi E Bahia Tortugas. Desierto Vizcaino (27°35 N, 114°10′W), 28 mi SW El Crucero, El Pescadero, 7 and 9.2 mi SE Guerrero Negro, 12 mi S Guillermo Prieto, Laguna Ojo de Lievre (27°46′N, 114°10′W). La Paz. 13 air km WNW La Purisima. Los Barriles. Los Frailes. 16 mi E Rosarito, San Carlos, 15 mi N San Ignacio, E edge of Sierra Placeres (27°35′N, 114°30′W) **Chihuahua:** Moctezuma. Samalayuca. **Sinaloa:** 8 mi S Elota **Sonora:** Cerro Pinacate (McDougal Crater). Guaymas. 39 mi S Puerto Peñasco. Tepoca Bay

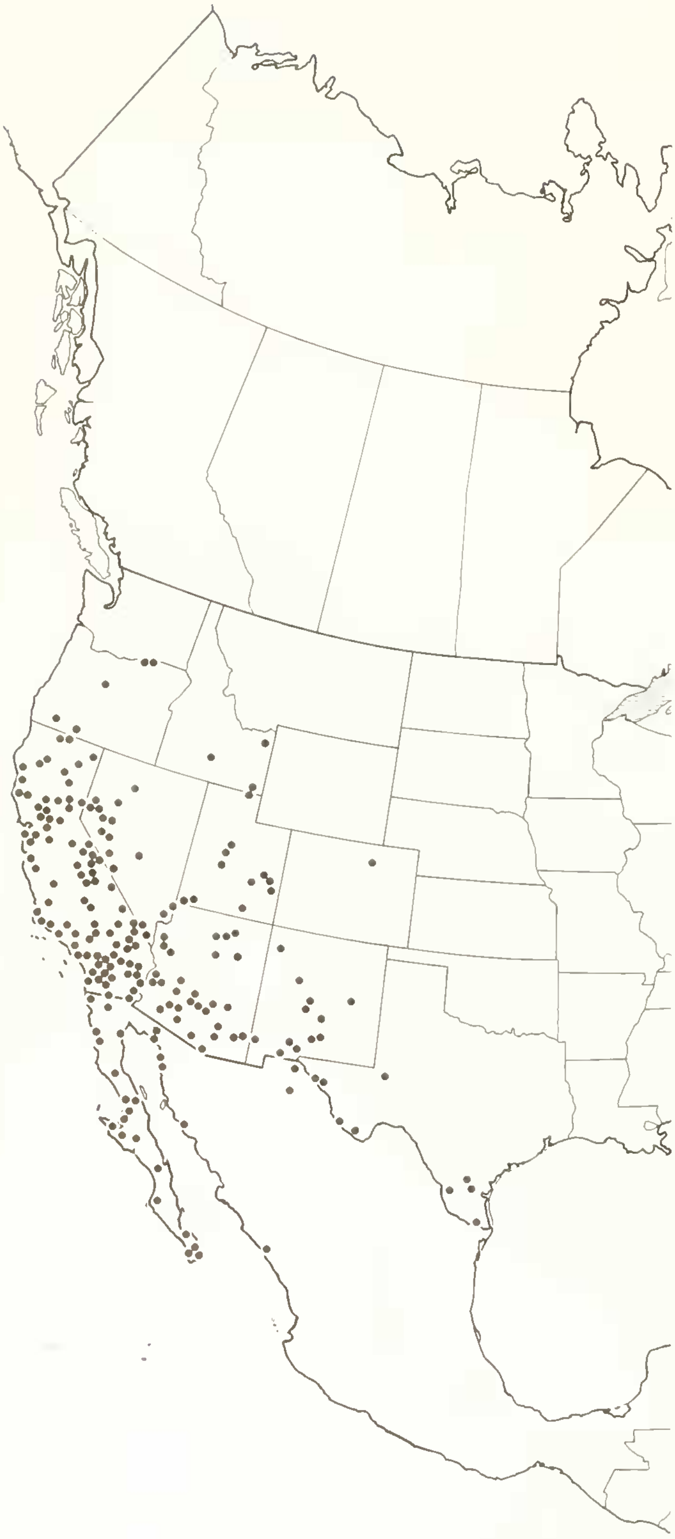

FIGURE 87. Geographic distribution of *Tachysphex yolo* Pulawski.

Tachysphex yuma Pulawski

(Figures 88, 89)

Tachysphex yuma Pulawski, 1982:39, ♀, ♂. Holotype: ♂, Mexico: Baja California Sur: La Paz (CAS, Type #13966).

DIAGNOSIS.—*Tachysphex yuma* has a punctate mesopleuron (punctures shallow), the midscutal setae are oriented posterolaterad (transversely in some males), and sternum I has an apical depression (which is weakly defined in some specimens). Several other species share this combination of characters, but they have a uniformly ridged propodeal side (ridges evanescent in many *yolo*). In *yuma*, the propodeal side varies: it is either coarsely ridged posteriorly and microridged along the metapleural sulcus; or (most specimens) nonridged along the metapleural sulcus and ridged along the dorsal margin (Fig. 88b), or dorsal and posterior; or all unridged (some males). Furthermore, the flagellum of *yuma* is somewhat longer; for example, the length of flagellomere IV is 3.6–4.2 (female) and 2.0–2.4× (male) width, and up to 3.2 and 2.0×, respectively, in the other species. In the male, the unusually broad clypeal lobe is distinctive (see Description below), and the velvety sternal pubescence is an additional recognition feature.

DESCRIPTION (see also Table 2 under *texanus*, p. 123).—Punctures nearly contiguous or some punctures up to two diameters apart on vertex; nearly contiguous on scutum or (some specimens) one to several diameters apart on disk; shallow on mesopleuron, averaging less than one to more than one diameter apart beneath mesopleural scrobe. Propodeal dorsum evenly microareolate to slightly rugose; side in most specimens ridged along dorsal and often posterior margins, unridged along metapleural sulcus (Fig. 88b); unridged in some males; entirely ridged in a female from Redding, California, but ridges evanescent anteriorly and coarse posteriorly.

Setae 1.0 MOD long on vertex; on scutum at middle oriented mostly posterolaterad, but transversely in some males; erect or nearly so on hypoepimeral area; subappressed below mesopleural scrobe.

Mandible in most specimens reddish at middle; gaster red or (single male from Todos Santos, Mexico) tergum I black. Legs usually black, with tarsal apex reddish, but largely red in a female from Deep Canyon, California (are red: forefemur apically, midfemur apically and ventrally, hindfemur, tibiae partly, tarsi). Terga I–IV silvery fasciate apically (fasciae interrupted in female); only hindfemur and tarsal apex are red in a female from Chocolate Mountains, California. Wings moderately infumate to (many males) hyaline.

♀.—Clypeus (Fig. 88a): bevel about as long as basomedian area; lip arcuate. Dorsal length of flagellomere I 2.4–3.0× apical width; of flagellomere IV 3.6–4.2× width. Vertex width 1.0–1.2× length. Dorsal micropunctures of tergum II two to three diameters apart. Tergum V sparsely punctate at middle. Length 10.5–12.0 mm.

Vestiture not obscuring sculpture between antennal socket and orbit. Scutal setae mostly appressed, but some setae erect, about 0.5 MOD long.

♂.—Clypeus (Fig. 88c): bevel ill defined; lip straight or with obtuse, median projection, its corners well defined; distance between corners 1.4–1.6× clypeal length and 1.4–1.5× the distance between corner and orbit. Dorsal length of flagellomere I

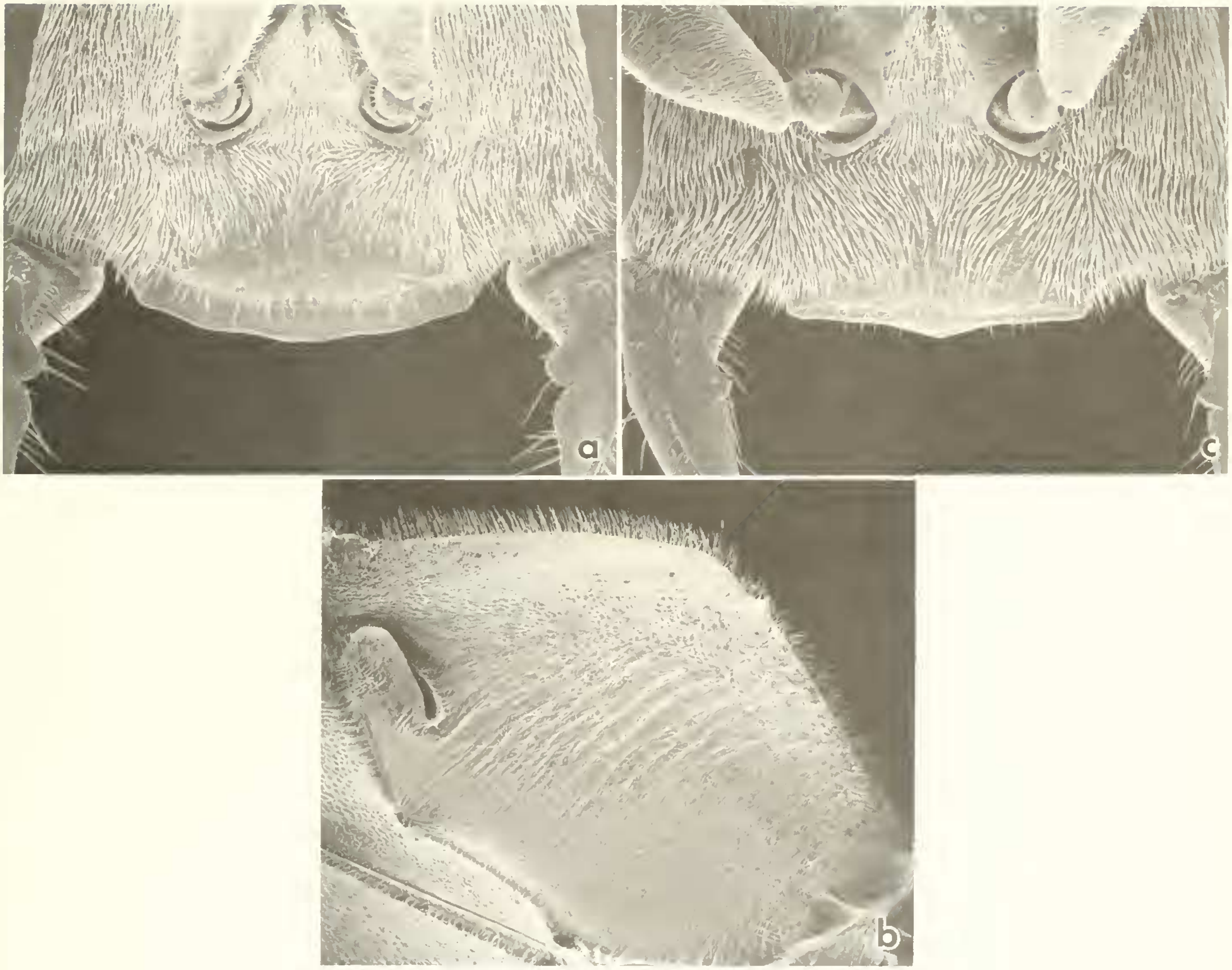

FIGURE 88. *Tachysphex yuma* Pulawski: a—female clypeus; b—female propodeum, c—male clypeus.

1.4–1.7× apical width; of flagellomere IV 2.0–2.4× width. Vertex width 1.2–1.7× length. Sterna evenly, minutely punctate (punctures less than one diameter apart), but sterna II–V apically impunctate, glabrous. Outer margin of forebasitarsus without preapical spines or (occasional specimens) with one or two such spines that are shorter than basitarsal width. Length 7–11 mm.

Integument largely obscured by vestiture between antennal socket and orbit. Scutal setae suberect, about 0.5 MOD long. Sternal pubescence velvety, largely obscuring integument.

GEOGRAPHIC DISTRIBUTION (Fig. 89).—Idaho, Oregon, California, southern Nevada, Arizona, southwestern Texas, northern Mexico (Sonora, Baja California).

MATERIAL EXAMINED.—44♀, 63♂ (CAS, CIS, CSDA, CSU, CU, KU, LACM, NSCA, NYSU, SDNH, UAE, UCD, UCR, UIM, UMMZ, USNM, USU).

RECORDS.—UNITED STATES. ARIZONA. **Cochise:** Portal (also 5 and 6 mi SW). **Coconino:** Grand Canyon National Park (15 mi NE Phantom Ranch). **Maricopa:** Wickenburg. **Santa Cruz:** Canelo. **Yavapai:** Yarnell. CALIFORNIA. **Imperial:** Black Mountain (Chocolate Mts.), 20 mi E Glamis. **Inyo:** Bishop, Darwin Falls, Panamint Springs, Surprise Canyon. **Los Angeles:** Claremont. **Riverside:** Boyd Desert Research Center (4 mi S Palm Desert), Deep Canyon, Palm Springs, Salton Beach, Thousand Palms Canyon, Whitewater. **San Bernardino:** 3 mi N Cross Roads. **Shasta:** Redding. **Stanislaus:** Empire. **Tuolumne:** Mather. IDAHO: **Twin Falls:** Rock Creek Canyon (19 mi S Hansen). NEVADA. **Clark:** Juanita Springs (10 mi S Riverside). OREGON: **Malheur:** 4 mi N Juntura. TEXAS: **Brewster:** 20 mi NNW Marathon.

MEXICO. **Baja California Norte:** 30 mi N Guerrero Negro, Isla de Cedros (Punta Norte, Cerro de Cedros), 65 mi S San Felipe. **Baja California Sur:** 30 mi ESE Bahia Tortugas, 35 km S Mulege, Rancho El Coyote, 16 mi E Rosarito, 3 and 15 mi W San Ignacio (also 10 mi E), Todos Santos. **Sonora:** Bahia San Carlos.

Tachysphex texanus (Cresson)

(Figures 90–92)

Larrada texana Cresson, 1872:214. ♀, ♂. Lectotype: ♀, Texas, no specific locality (ANSP), designated by Cresson 1916:96.—In *Tachytes*: Patton 1879:368, Snow 1881:99.—In *Larra*: Patton 1881:389, Kohl 1885:248.—In *Tachysphex*: W. Fox 1894*a*:513, Dalla Torre 1897:686, Ashmead 1899:250, Hartman 1905:29, Williams 1914:166, 206, Mickel 1918:422, G. Bohart 1951:953, Krombein 1967:394, Bohart and Menke 1976:277; Krombein 1979:1630; Rust et al. 1985:46, 53, Kurczewski 1987:122.

Tachysphex sepulcralis Williams, 1914:169, ♀, ♂. Holotype: ♀, Kansas: Phillips

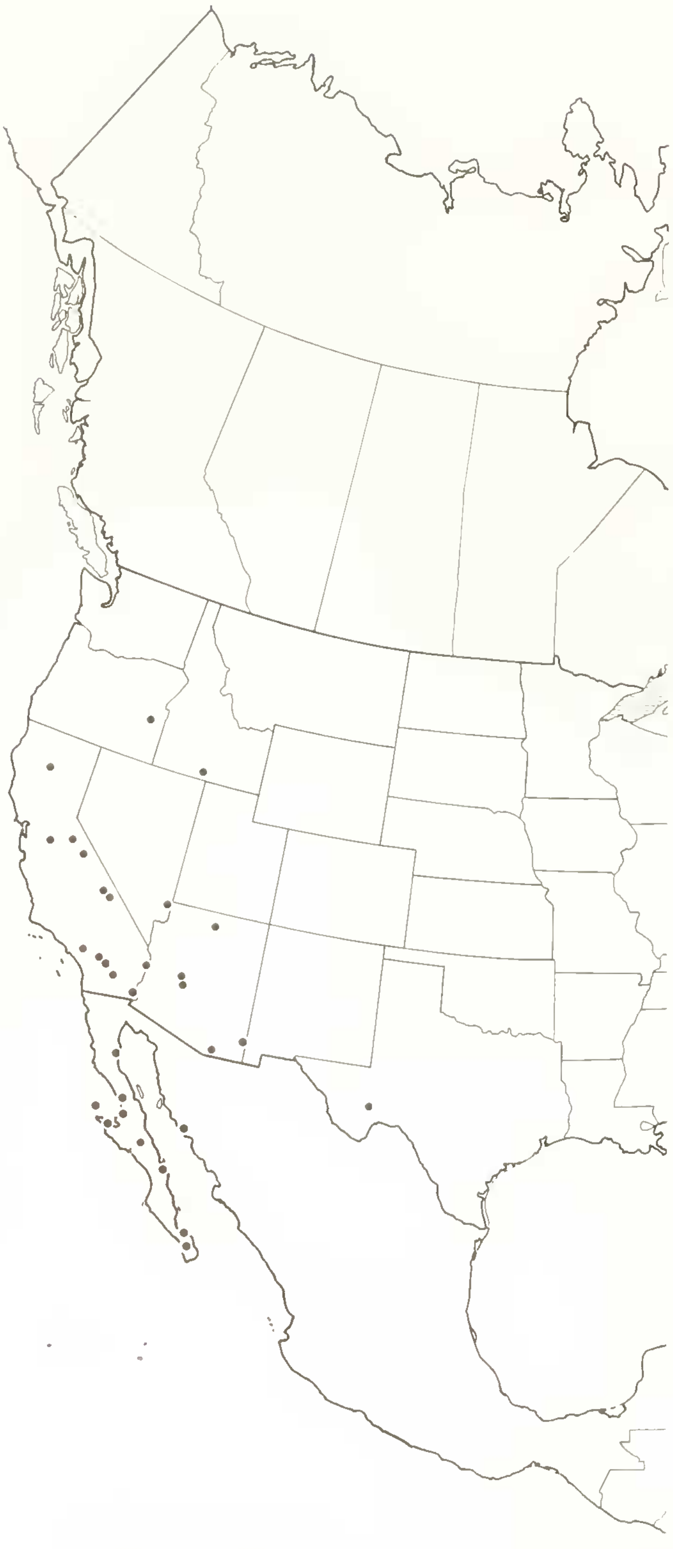

FIGURE 89. Geographic distribution of *Tachysphex yuma* Pulawski.

Co.: no specific locality (KU). Synonymized by Pulawski *in* Krombein 1979:1630.—Krombein 1953*a*:330, LaBerge 1956:528 (as *sepulchralis*), Krombein 1958*c*:188, 1967:393, Arnaud 1970:33, Bohart and Menke 1976:277.

Tachysphex mancei Banks, 1921:19, ♂. Holotype: ♂, North Carolina: Southern Pines (MCZ). Synonymized with *sepulcralis* by G. Bohart 1951:952.—Brimley 1938:443.

DIAGNOSIS.—*Tachysphex texanus*, a common transcontinental species, belongs to a lineage within the *pompiliformis* group in which midscutal setae are oriented laterad (Fig. 90b, c), mesopleural punctures are well defined (Fig. 91a, b), and sternum I has a horizontal depression at apex (Fig. 91c, d). No one character separates the female from all other species of the lineage, but the following combination is diagnostic: (1) mesopleural setae appressed or nearly so below scrobe (subappressed to suberect below the scrobe in *sonorensis* and *tsil*), (2) punctures average less than one diameter apart below mesopleural scrobe (more than one diameter in *sonorensis*, *tsil*, and many *lamellatus*), (3) mesopleural integument easily visible (partly obscured by vestiture in many *yolo*), (4) clypeal lip arcuate (sinuate in *huchiti*, undulate in *arizonac* and *lamellatus*), (5) dense punctation of clypeal lobe not attaining lip base (attaining lip base laterally in *yolo*), (6) dorsal length of flagellomere I 1.9–2.2× apical width in eastern and 2.0–2.4× in western populations (2.0–2.1× in *huchiti*, a western species), (7) length of flagellomere IV no more than 3.2× width (3.6–4.2× in *yuma*), (8) propodeal side evenly ridged (ridges evanescent in many *yolo*, absent anteriorly in *yuma*), (9) sternum II micropunctate basally and laterally (micropunctures absent from base to apex along midline in most *yolo*), and (10) body length 7.5–10.5 mm (6.5–9.0 mm in *huchiti*).

The male of *texanus* differs from most of these species in having a basically truncate (Fig. 90d, e) clypeal lobe (instead of triangular) and also in having velvety sternal pubescence (Fig. 91e). *Tachysphex arizonac* is similar, but in that species the corner of the clypeal lobe is more prominent (Fig. 95b), and the mesopleural setae are suberect below the scrobe (setae appressed or nearly so in *texanus*). *Tachysphex yuma* and *tsil* also are similar, but in the former the clypeal lobe is much broader, and in the latter it is much narrower, than in *texanus* (compare Fig. 90d and 99).

DESCRIPTION (see also Table 2).—Punctures up to one or two diameters apart on vertex; less than one diameter apart on scutum in most specimens (a few discal punctures sometimes more than that); averaging less than one diameter apart beneath mesopleural scrobe (but more than that in some males), subcontiguous in most females. Propodeal dorsum usually rugose, occasionally areolate. Discal micropunctures of tergum II two to three diameters apart.

Vestiture dense but not entirely obscuring integument between antennal socket and orbit. Setae 0.8–1.0 MOD long on vertex, appressed beneath mesopleural scrobe.

Legs black, tarsal apex brown. Gaster red to black (see Variation below), terga I–III or I–IV silvery fasciate apically. Wings hyaline to slightly infumate.

♀.—Clypeus (Fig. 90a): bevel equal to basomedian area or shorter; lip arcuate, slightly obtusely projecting mesally in some specimens. Dorsal length of flagellomere I 1.9–2.4× apical width. Vertex width slightly more to slightly less than length. Tergum V densely punctate (except in some females from California and Mexico). Length 7.5–10.5 mm.

Scutal setae appressed, but usually a few sparse, suberect setae present, about as long as 0.6 MOD.

♂.—Clypeus (Fig. 90b, c): bevel delimited laterally by short,

TABLE 2. SOME CHARACTERS OF *TACHYSPHEX TEXANUS* AND ITS RELATIVES.

Character	Species								
	am	ar	hu	la	so	te	ts	yo	yu
Frontal punctures									
Less than one diameter apart in all individuals	1	1	1	1	0	1	1	1	1
Up to one diameter apart in some females	0	0	0	0	1	0	0	0	0
Mesopleural punctures									
Well-defined in all individuals	1	1	1	1	1	1	1	0	1
Evanescent in some individuals	0	0	0	0	0	0	0	1	0
Propodial side ridges									
Present in all individuals	1	1	1	0	1	1	1	0	0
Evanescent in some individuals	0	0	0	1	0	0	0	1	1
Propodeal hindface ridged	1	1	1	1	1	1	1	1	1
Sternum I apicomesally									
With horizontal depression	0	1	1	1	1	1	1	1	1
Gradually sloping	1	0	0	0	0	0	0	0	0
Hindcoxa									
Carinate on whole length	0	1	0	0	1	1	1	1	1
Carinate basally	0	0	1	1	0	0	0	0	0
Finely ridged along inner margin	1	0	0	0	0	0	0	0	0
Vertex setae erect	1	1	1	1	1	1	1	1	1
Midscutal setae oriented									
Laterad in all individuals	1	1	1	1	0	1	0	0	0
Laterad or posterolaterad	0	0	0	0	1	0	1	0	1
Laterad or radially	0	0	0	0	0	0	0	1	0
Setae of propodeal dorsum oriented anterolaterad	1	1	1	1	1	1	1	1	1
Setae of midfemoral venter appressed or nearly so	1	1	1	1	1	1	1	1	1
Head and thorax black	1	1	1	1	1	1	1	1	1
Frontal vestiture									
Silvery in all individuals	0	1	1	1	1	1	1	1	1
With golden tinge in some males	1	0	0	0	0	0	0	0	0
Female clypeal lip									
Notched mesally	0	0	0	0	0	0	0	0	0
Incised laterally	0	0	0	0	0	0	0	0	0
Female: apical depression of tergum V punctate	0	0	0	0	0	0	0	0	0
Female: pygidial plate alutaceous, punctate	1	1	1	1	1	1	1	1	1
Female: trochanteral venter minutely, densely punctate	1	1	1	1	1	1	1	1	1
Male: mandibular inner margin:									
With tooth in all specimens	1	1	0	0	0	1	1	0	1
With tooth in some specimens	0	0	0	0	0	0	0	1	0
Without tooth	0	0	1	1	1	0	0	0	0
Male clypeal bevel in relation to basomedian area:									
Shorter to equal in length	1	0	0	0	0	0	0	0	0
Shorter	0	1	1	1	1	1	1	1	1
Male: sternal pubescence velvety	1	1	1	0	0	1	1	0	1
Male forefemoral notch									
Pruinose in all individuals	1	1	1	1	0	0	1	1	1
Glabrous in some individuals	0	0	0	0	1	1	0	0	0
Male: preapical spines on outer margin of foretarsus:									
Present in all individuals	0	0	0	0	1	0	0	0	0
Present in some individuals	0	0	0	0	0	0	0	1	1
Male: outer apical spine of foretarsomere II in relation to foretarsomere III:									
Shorter in all individuals	1	1	1	1	1	1	1	0	1
Longer in some individuals	0	0	0	0	0	0	0	1	0

0 = character absent, 1 = character present, am = *amplus*, ar = *arizonae*, hu = *huchiti*, la = *lamellatus*, so = *sonorensis*, te = *texanus*, ts = *tsil*, yo = *yolo*, yu = *yuma*

small, longitudinal carina extending from lip corner; lip straight, arcuate or sinuate, with prominent corners that are about as close to orbit as to each other (in most specimens from Baja California, the distance between corners is about 0.8 of distance between a corner and orbit). Dorsal length of flagellomere I 1.1–1.4× apical width. Vertex width 1.2–1.4× length. Sterna evenly, minutely punctate (punctures less than one diameter apart), but sterna II–V apically impunctate, glabrous. Length 6–8 mm.

Scutal setae suberect, 0.8–1.0 MOD long. Sternal pubescence velvety.

VARIATION.—*Tachysphex texanus*, a widely distributed species, varies geographically in the color of the gaster and in the form of the male clypeus. Several forms can be distinguished, but I do not recognize them as formal subspecies because of intergradation in broad intermediate areas.

1) Generally, the gaster is black in specimens taken east of

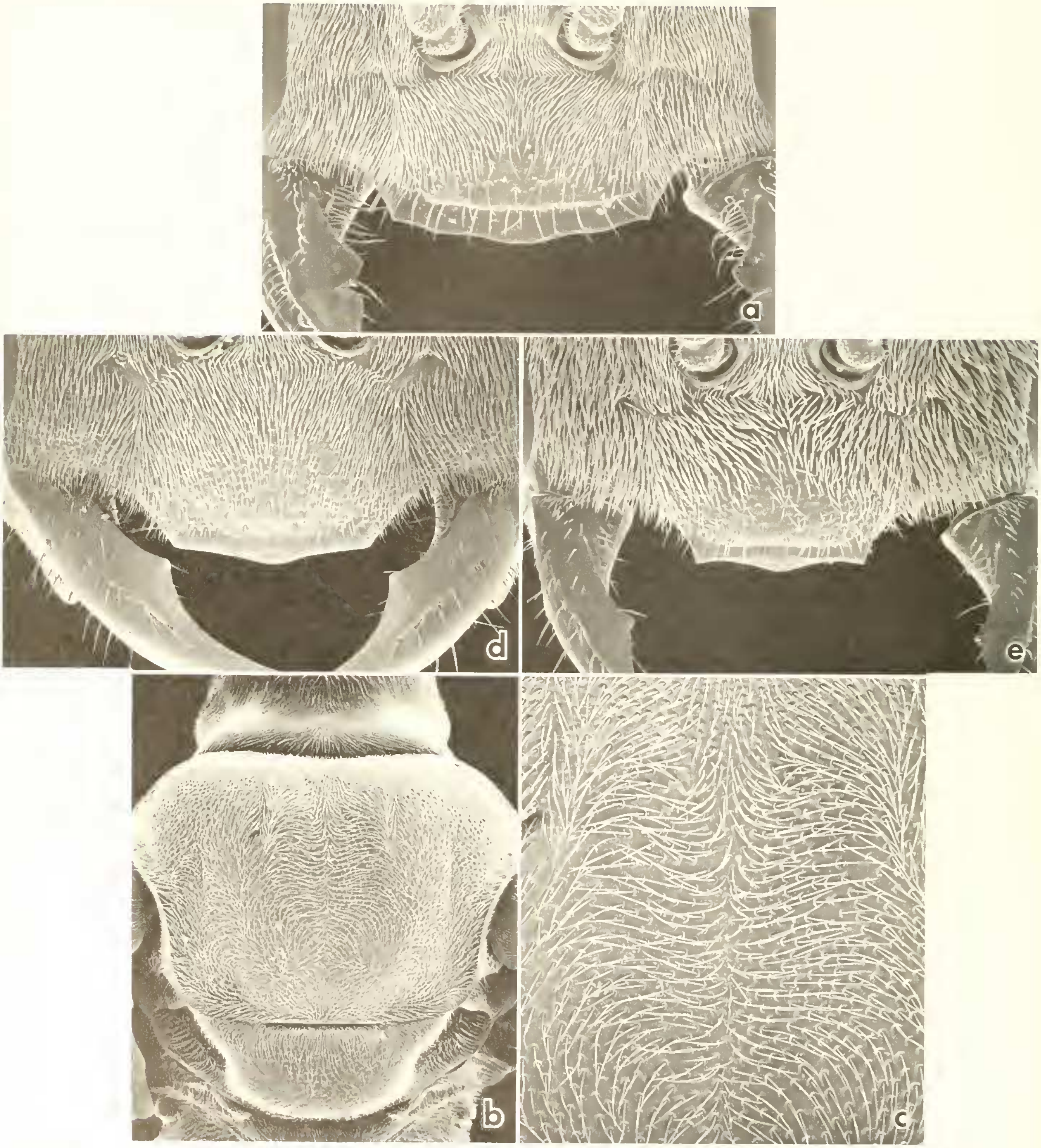

FIGURE 90. *Tachysphex texanus* (Cresson). a—female clypeus, b—female pro- and mesothorax, dorsal view, c—midscutal setae of female; d—male clypeus, e—same, different specimen.

the 95th meridian, as well as many Kansas individuals. The length of female flagellomere I is 1.9–2.2 × width, and the clypeal lip of most males is sinuate (with a mesal projection) or arcuate.

2) Specimens from Nebraska, South Carolina, Georgia, Alabama, and Florida are similar to the previous form, but gastral segments I–III are red. However, one male from Gainesville, Florida, is all black.

3) West of the 95th meridian (except many Kansas specimens) the gaster is red, although segments V–VII may be brown in occasional males. The length of female flagellomere I is 2.0–

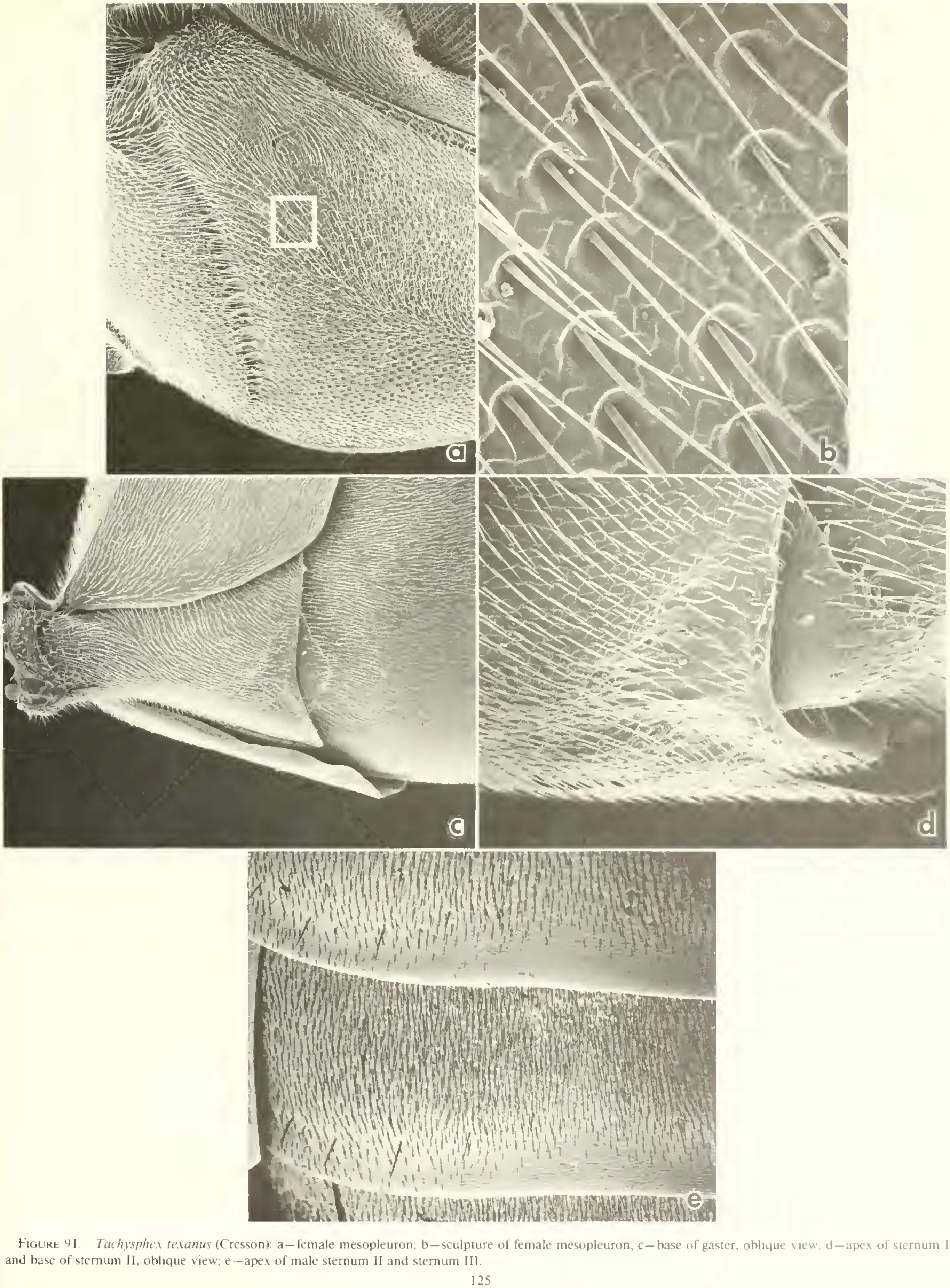

FIGURE 91. *Tachysphex texanus* (Cresson): a—female mesopleuron; b—sculpture of female mesopleuron, c—base of gaster, oblique view, d—apex of sternum I and base of sternum II, oblique view; e—apex of male sternum II and sternum III.

2.4 × width, and the clypeal lip of most males is straight or nearly so, or it has a small, mesal projection; it may also be sinuate.

The velvety pubescence of the male sterna normally is so dense that it almost totally obscures the integument. However, it is relatively sparse in three males from Glenrock, Wyoming (USNM), in which the integument is easily visible.

Life History.—Krombein (1953*a*) observed *texanus* on the foliage of *Pinus serotina* Michx. and *Liquidambar*. A male (UMMZ) from E. S. George Reserve, Michigan, was collected on flowers of *Daucus carota* L., and two females (CIS) from Animas, New Mexico, were taken on flowers of *Helianthus annuus* L. Williams (1914) observed a female carrying her prey, an immature oedipodine grasshopper of very small size that Kurczewski (1987) identified as *Arphia* sp. Rust et al. (1985) noted a female collected with its acridid prey, an immature *Encoptolophus robustus* Rehn and Hebard, on Santa Cruz Island, California. Kurczewski (1987) observed a nesting female near Lecompton, Kansas. Prey were flown to the nest and either taken inside directly or first dropped at the entrance and then pulled in. Kurczewski did not say it explicitly, but his observation suggests that the nest was permanently open during the provisioning period. The nest had an oblique gallery and a single, fully provisioned cell that contained four acridid prey. Three prey were nymphal *Melanoplus* sp. near *flavidus* Scudder and one was a nymphal *Orphulella pelidna* (Burmeister). The egg was laid on the forecoxal corium of the second largest prey, and extended between the fore- and midcoxae. Hartman (1905) reported that *texanus* caught and impaled a fly "of the domestic species," but this statement indicates that he was observing an *Oxybelus*.

Geographic Distribution (Fig. 92).—Alberta to central Mexico; transcontinental.

Material Examined.—980♀, 1,004♂.

Records (b: gaster all or predominantly black).—CANADA: **Alberta:** 10 mi N Coaldale, Writing-on-Stone Provincial Park.

UNITED STATES: ALABAMA: **Baldwin:** Gulf Shores. **Montgomery:** Montgomery. ARIZONA: **Apache:** 5 and 10 mi W Springerville, Vernon. **Cochise. Coconino:** Antelope Hills (25 mi N Flagstaff). **Maricopa:** 3 mi SW Maricopa, Wickenburg (also 5 mi SE). **Mohave:** 3 mi E Hackberry, Wikieup. **Navajo:** 10 mi N Show Low. **Pima. Pinal:** Picacho Pass. **Santa Cruz. Yavapai:** Congress, Yarnell in Weaver Mts. ARKANSAS: **Conway:** —(b). CALIFORNIA: **Alameda. Amador:** —. **Butte:** Chico. **Contra Costa. El Dorado:** 6–9 mi NE on Icehouse road, Placerville. **Fresno. Glenn:** Artois. **Humboldt:** 3 mi NE Alderpoint, 5 mi NE Briceland, 5 mi NW Garberville. **Imperial:** Experimental Farm, Palo Verde. **Inyo. Kern. Lake:** North Fork Cache Creek at Highway 20. **Lassen:** Doyle, Hallelujah Junction. **Los Angeles:** including San Clemente Island and Santa Catalina Island. **Marin. Mariposa:** El Portal, Mariposa. **Mendocino. Merced:** Merced Falls. **Modoc:** 5 and 9 mi NE Alturas, Davis Creek. **Mono:** Aurora Canyon (4 mi E Bridgeport), Topaz Lake. **Monterey. Napa. Nevada:** Boca, 2 mi S Grass Valley, Nevada City. **Orange. Placer:** Auburn. **Plumas. Riverside. Sacramento:** Fair Oaks, Folsom (also 10 mi NE). **San Benito:** Idria, Panoche, Pinnacles National Monument. **San Bernardino. San Diego. San Francisco:** San Francisco (Lone Mountain). **San Joaquin:** Corral Hollow (8 mi SW Tracy), Tracy. **San Luis Obispo:** 5 mi S Creston, La Panza (12 mi NE Pozo), Montana de Oro State Park (3 mi SW Los Osos), Paso Robles. **San Mateo:** Menlo Park, Redwood City. **Santa Barbara:** including Santa Cruz Island and Santa Rosa Island. **Santa Clara. Santa Cruz:** 4 mi E Boulder Creek. **Shasta. Sierra:** 6 mi E Downieville, Sierraville. **Siskiyou. Solano:** Green Valley, Pleasant Valley Road 0.5 mi S Highway 128, 2 mi SE Vallejo. **Sonoma:** Cloverdale, 2 mi W Forestville, Petaluma. **Stanislaus:** Del Puerto Canyon (21 mi W Patterson). **Trinity:** Hayfork, Scott Mt. **Tulare:** Lemon Cove, Potwisha (junction of Marble and Middle Forks of Kaweah River). **Tuolumne. Ventura. Yolo.** COLORADO: **Bent:** 2 mi S Hasty. **Boulder:** Boulder. **Cheyenne:** Aroya. **Larimer:** Fort Collins. **Logan:** 10 mi E Sterling. **Mesa:** Colorado National Monument. **Otero:** La Junta. **Prowers:** Carlton. **Weld:** Owl Creek (8, 11, and 19 mi NE Nunn), 1 mi NE Roggen. CONNECTICUT: **Hartford:** Hartford (b). FLORIDA: **Alachua:** Gainesville (partly b), Monteoca (11 mi NW Gainesville). **Collier:** —. **Dade:** Fuch's Hammock near Homestead. **Gadsden:** Quincy. **Highlands:** Highlands Hammock State Park, Lake Placid, Sebring area. **Lee:** Olga. **Levy:** Cedar Key. **Liberty:** Torreya State Park. **Marion:** Lake Eaton, 9 mi SSW Ocala. **Monroe:** Big Pine Key, Fleming Key, Grassy Key. **Pinellas:** Tarpan Springs. **Polk:** Avon Park Airforce Range. **Putnam:** 2 mi NW Orange Springs. **Santa Rosa:** 4 mi W Lake Carr. **Sarasota:** Myakka River State Park. **Suwannee:** Suwannee River State Park. GEORGIA: **Clarke:** Athens. **Fulton:** Atlanta. **Liberty:** St. Catherine's Island. **Miller:** Spring Creek. IDAHO: **Ada:** Regina (also 12 mi N, 12 mi NW). **Blaine:** 2 mi W Carey. **Canyon:** Murphy. **Elmore:** 4 mi E Orchard. **Gooding:** 1 mi NE Gooding (also 12 mi N). **Nez Perce:** Lewiston. **Oneida:** Black Pine Canyon, 5 mi NW Holbrook. **Owyhee:** Silver City. **Twin Falls:** Rogerson. ILLINOIS: **Macoupin:** Carlinville (b). **Washington:** Dubois (b). KANSAS: **Barber:** 15 mi W Medicine Lodge. **Barton:** —(partly b). **Dickinson:** Abilene (b). **Douglas:** Baldwin (b), Lawrence (b). **Ellis, Graham, Grant** (b). **Hamilton, Meade, Ness, Norton, Phillips** (partly b). **Rooks, Russell** (b), **Sedgwick** (b), **Smith, Stevens:** —. MASSACHUSETTS (b): **Middlesex:** Holliston. **Norfolk:** Wellesley. MICHIGAN (b): **Iosco:** —. **Livingston:** E. S. George Reserve. **Midland, Ogemaw, Roscommon:** —. **Washtenaw:** Stinchfield Woods. MINNESOTA: **Wabasha:** 3 mi SE Dumfries (b). MISSOURI: **Boone:** Columbia (b). MONTANA: **Garfield:** 5 mi W Jordan. **Yellowstone:** 6 mi NE Pompeys Pillar. NEBRASKA: **Dawes:** Chadron. **Keith:** Ogallala. **Sioux:** 7 and 18 mi N Harrison. NEVADA: **Churchill:** Fallon, 3 mi W Hazen. **Clark. Douglas:** Topaz Lake. **Elko:** 3 mi N Currie, 50 mi S Wells. **Esmeralda:** 15 mi S Goldfield. **Eureka:** 6 mi S Beowawe, 1 mi W Emigrant Pass. **Humboldt:** Orovada. **Lander:** 2 mi NW Tenabo. **Lincoln:** 18 mi S Caliente. **Lyon:** Yerington. **Mineral:** 3 mi SE Schurz (also 4.5 mi S). **Nye:** Black Rock Summit, 24 mi E Tonopah. **Pershing:** 7 mi E Oreana. **Storey:** Lagomarsino Canyon. **Washoe.** NEW MEXICO: **Bernalillo:** Chilili. **Catron:** Pie Town. **Chaves:** Mescalero Sands. **De Baca:** Sumner Lake State Park. **Dona Ana:** Hatch, Las Cruces. **Eddy:** Carlsbad, Hope, Whites City. **Grant:** 1 mi S Silver City. **Harding:** Chicosa Lake State Park. **Hidalgo. Lincoln:** Carizozo, Nogal. **Luna:** Columbus. **McKinley:** Pinedale. **Otero:** Alamogordo, High Rolls Mountain Park (also 3 mi W). **Quay:** Tucumcari. **San Miguel:** Las Vegas. **Santa Fe:** 10 mi N Santa Fe. **Socorro:** La Joya (20 mi N Socorro), 31 mi E San Antonio. **Taos, Torrance:** —. NEW YORK (b): **Suffolk:** Orient, Riverhead. NORTH CAROLINA: **Cumberland:** Fort Bragg (partly b). **Dare:** Kill Devil Hills (b). **Moore:** Southern Pines (b). NORTH DAKOTA: **Golden Valley:** Beach. **Ransom:** 7 mi SE Sheldon (b). OKLAHOMA: **Cimarron:** Black Mesa State Park. **Garfield, Texas:** —. OREGON: **Baker:** Pleasant Valley. **Benton:** Corvallis. **Deschutes:** Smith Rock State Park, 3 mi N Terrebonne. **Jackson:** 6 mi N Copper, Shady Cove. **Jefferson:** 10 mi S Madras. **Josephine:** Illinois Valley. **Klamath:** 3 mi S Beatty, Harpold Dam, Upper Klamath Lake. **Malheur:** 57 mi W Jordan Valley, 4 mi E Juntura. **Wallowa:** 18 mi NNE Imnaha. SOUTH CAROLINA: **Aiken:** New Ellenton. **Charleston:** McClellanville. **Horry:** Myrtle Beach. **Pickens:** Dovenhaven (7 mi NE Pickens). SOUTH DAKOTA: **Fall River:** 5 mi S Oelrichs. TEXAS: **Bastrop:** 6 mi E Bastrop (partly b). **Bexar:** Fort Sam Houston. **Bosque:** —. **Brewster. Caldwell:** Luling (b). **Crockett:** Fort Lancaster State Historical Park. **Culberson:** Kent. **Dallam:** Conlen, Dalhart. **Galveston:** Galveston (also 7 mi W). **Gillespie:** Cherry Springs. **Gonzales:** Palmetto State Park (b). **Hartley:** Weatherford Ranch. **Hidalgo:** Bentsen Rio Grande Valley State Park, McAllen Botanical Garden. **Hudspeth:** McNary, Sierra Blanca (also 5 mi E). **Jeff Davis:** Davis Mts., 10 mi W Fort Davis (also 25 mi N). **Kimble:** Junction. **Kleberg:** Baffin Bay 20 mi SE Kingsville. **La Salle:** Cotulla. **Lee:** Fedor (partly b). **Palo Pinto:** Possum Kingdom State Park. **Presidio:** 11 mi N Presidio. **Randall:** Canyon. **Starr:** Falcon State Park. **Ward:** 1 mi S Grandfalls. **Zapata:** Falcon State Park. UTAH: **Box Elder:** 10 mi SW Snowville. **Duchesne:** Duchesne. **Emery, Garfield, Grand. Juab:** Trout Creek. **Millard:** Oak City. **Uintah:** 17 mi S Bonanza, Green River Valley. **Utah:** Lehi. **Washington.** VIRGINIA: **Prince Edward:** Farmville (b). WASHINGTON: **Grant:** Columbia River near Vantage, O'Sullivan Dam. WYOMING: **Converse:** Glenrock. **Lincoln:** Opal. **Natrona:** Powder River. **Sheridan:** 5 mi N Sheridan. **Washakie:** 11 mi SW Worland. **Weston:** Newcastle.

MEXICO: **Baja California Norte. Baja California Sur:** including Isla Cerralvo (Ruffo Ranch) and Isla San Esteban. **Chihuahua:** 10 mi N Chihuahua (also 35 and 45 mi), Hidalgo del Parral, Santa Clara Canyon (5 mi W Parrita). **Coahuila:** 15 mi N Saltillo. **Jalisco:** Lagos de Moreno. **Sinaloa:** 8 mi SE Elota, Playa Baviri (17 mi W Los Mochis). **Sonora:** Ciudad Obregon, La Playa area, San Carlos (also 6 km NNW), San Vicente. **Tamaulipas:** 30 mi S Matamoros. **Zacatecas:** 8 mi N Ojo Caliente, San Juan Capistrano (22°38′N, 104°05′W).

Tachysphex huchiti sp. n.

(Figures 93–94)

Derivation of Name.—Named after the Huchiti Indians of southern Baja California Sur, where the holotype was collected; noun in apposition.

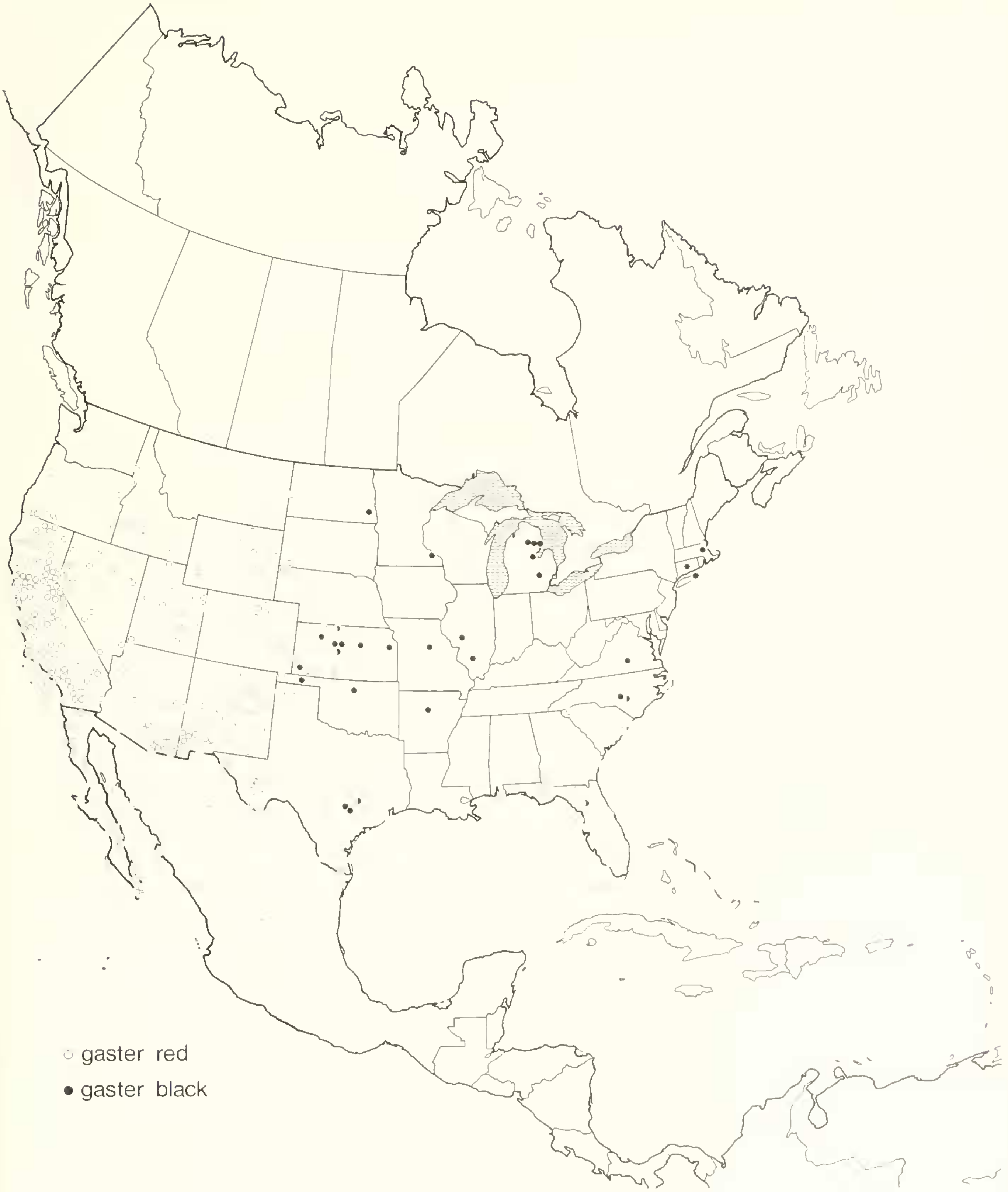

FIGURE 92. Geographic distribution of *Tachysphex texanus* (Cresson).

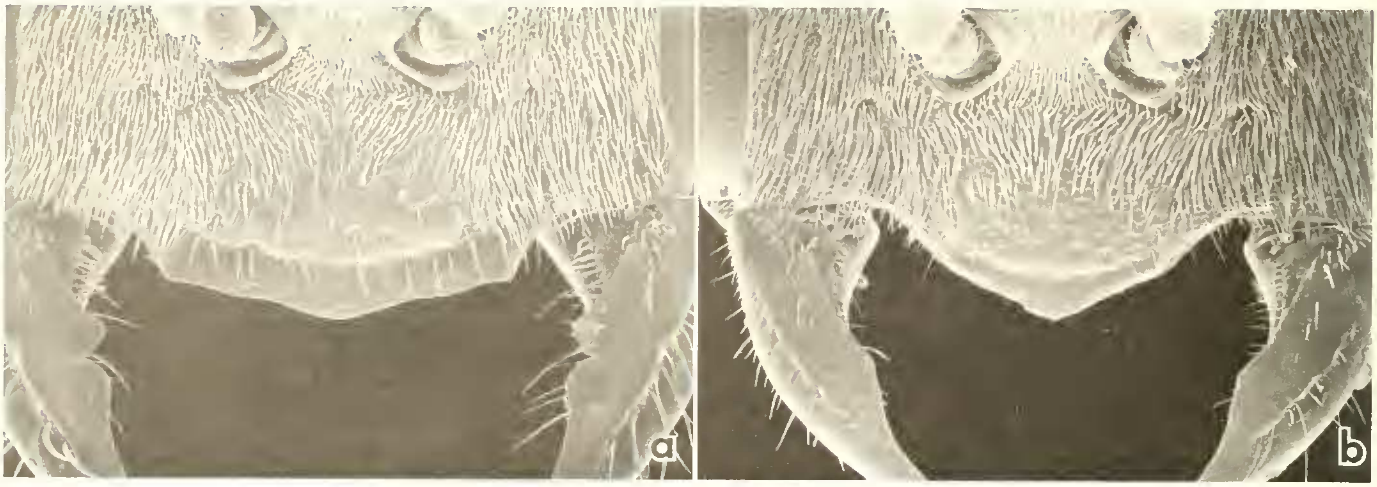

FIGURE 93. *Tachysphex huchiti* sp. n. a—female clypeus, b—male clypeus.

DIAGNOSIS.—*Tachysphex huchiti* belongs to a lineage of the *pompiliformis* group in which the midscutal setae are directed laterad, the mesopleuron is punctate, and sternum I is apically depressed. Within this lineage, most species have conspicuous diagnostic characters allowing immediate recognition. Females of *huchiti* and *texanus* lack such characters, but the following combination separates them from the remaining species: (1) clypeal lip not undulate (undulate in *arizonac* and *lamellatus*), (2) dense punctation of clypeal lobe attaining lip corner but not lip base (attaining lip base laterally in *yolo*), (3) length of flagellomere IV no more than 3.2 × width (3.6–4.2 × in *yuma*), (4) punctures below mesopleural scrobe averaging less than one diameter apart (more than one diameter apart in *sonorensis*, *tsil*, and many *lamellatus*), (5) mesopleural setae appressed or nearly so beneath scrobe (nearly erect in many *sonorensis* and *tsil*), (6) mesopleural integument easily visible (partly obscured by vestiture in many *yolo*), and (7) propodeal side evenly ridged (ridges evanescent in many *yolo*, absent anteriorly in *yuma*, Fig. 88b). The differences between *huchiti* and *texanus* are subtle. In *huchiti*, the clypeal lip is sinuate (Fig. 93a), flagellomere I is slightly shorter (dorsal length 1.9–2.1 × apical width), and average size is smaller (6.5–9.0 mm). In *texanus*, the clypeal lip is arcuate (Fig. 90a), flagellomere I is longer (dorsal length 1.9–2.2 × apical width in eastern and 2.2–2.4 × in western populations), and average size is larger (7.5–10.5 mm).

The male of *huchiti* can be easily recognized by the combination of an obtusely triangular clypeal lip (Fig. 93b) and velvety sternal pubescence. The nondentate inner mandibular margin is a subsidiary diagnostic character. Males of *lamellatus* are similar, but in that species the scutal setae are suberect, 1.3 MOD long anteriorly (subappressed, shorter than MOD in *huchiti*), the sternal pubescence is inconspicuous, and the hypostomal area of most specimens is distinctive (see *lamellatus* for details).

DESCRIPTION (see also Table 2 under *texanus*, p. 123).—Punctures almost contiguous on vertex and scutum, less than one diameter apart on mesopleuron. Propodeal dorsum areolate.

Vestiture obscuring integument between antennal socket and orbit from most angles. Setae about 0.8 MOD long on vertex, suberect on hypoepimeral area, appressed below mesopleural scrobe.

Legs black, tarsal apex reddish in most specimens. Gaster red (most specimens) or all black (a male from Drumheller, Alberta, and another from Surprise Canyon, California). Wings almost hyaline. Terga I–III (I–IV in many males) silvery fasciate apically.

♀.—Clypeus (Fig. 93a): bevel about as long as basomedian area; lip obtusely prominent mesally, weakly sinuate. Dorsal length of flagellomere I 1.9–2.1 × apical width. Vertex width 1.0–1.1 × length. Discal micropunctures of tergum II averaging two to three diameters apart. Punctures of tergum V sparse mesally. Length 6.5–9.0 mm.

♂.—Clypeus (Fig. 93b): lip obtusely triangular; free margin not angulate between lobe and lateral section; distance between lip corners about equal to clypeal length and to distance between corner and orbit. Dorsal length of flagellomere I 1.2–1.4 × apical width. Vertex width 1.1–1.4 × length. Sterna minutely punctate, punctures less than one diameter apart except more than one diameter apart on apical depression. Length 5.2–6.2 mm.

Sternal pubescence velvety, concealing integument or nearly so.

GEOGRAPHIC DISTRIBUTION (Fig. 94).—Alberta, California, southern Utah, southern Arizona, Baja California, and Chihuahua State in Mexico, and also northwestern Nebraska. The species occurs in a variety of habitats, from sandy arroyos with cacti in central Baja California to grassy hills north of San Francisco, California.

COLLECTING PERIOD.—18 March to 6 May and 7 October (Baja California), 20 September (Chihuahua), 2 May to 28 September (United States and Canada).

MATERIAL EXAMINED.—Holotype ♂, Mexico: Baja California Sur: Los Barriles, 3–4 May 1979, MSW (CAS, Type #14205).

Paratypes (62♀, 53♂): CANADA. **Alberta:** Drumheller, TLG (1♂, CAS).

UNITED STATES. ARIZONA. **Cochise:** 2 mi W Portal, WJP (1♀, CAS). **Pima:** Tucson, FDP and LAS (1♀, UCD). **Pinal:** Boyce Thompson Arboretum 3 mi W Superior, WJP (3♀, 3♂, CAS). CALIFORNIA. **Alameda:** Patterson Reserve, Del Valle Lake, JAP (1♀, CIS), no specific locality, J. C. Bridwell (1♂, USNM). **Contra Costa:** Canyon, W. R. Kellen (1♀, CIS), Danville, FXW (1♀, CAS), Mt. Diablo, FXW (3♂, CAS); San Pedro Reservoir, G. C. Eickwort (1♀, CU). **Inyo:** Surprise Canyon, PMM (1♂, UCD). **Marin:** 2 mi NE Bolinas, G. I. Stage (1♂, LACM); Mt. Tamalpais State Park, WJP (9♀, 10♂, CAS, 2♀, 2♂, MCZ, 1♀, 1♂, Zool. Mus. Copenhagen), San Rafael, collector unknown (3♀, 4♂, UCD, 1♀, 2♂, WJP); no specific locality, FXW (1♂, CAS). **Riverside:** Riverside, J. Hall (1♀, CAS, 2♀, UCR). **San Bernardino:** Providence Mts., TLG (1♂, TLG), Wildwood Canyon 3 mi E

Yucaipa (1♂, TLG). **San Diego:** Chihuahua Valley, EIS (1♂, UCD); Chula Vista, H. A. Dozier (1♂, UMMZ); La Mesa, FXW (2♀, CAS), Mission Gorge, R. B. Parks (1♀, SDNH). **San Mateo:** Redwood City, FXW (3♂, UCD). **Santa Clara:** Palo Alto, collector not indicated, gaster missing (1♂, LACM). **Sonoma:** Glen Ellen, RMB (1♂, UCD). **Stanislaus:** Del Puerto Canyon, PHA (1♂, CAS). NEBRASKA: **Dawes:** Chadron, R. W. Dawson (3♀, UCD, 1♀, WJP, 2♀, WSU). **Sheridan:** Rushville, R. W. Dawson (1♀, WSU). **Sioux:** Sawbelly Canyon, R. W. Dawson (1♂, UCD), same locality and collector, paratypes of *Tachysphex angularis* Mickel (2♂, CU, UNL). UTAH: **Garfield:** Capitol Reef National Park, Sulphur Creek, Lindahl (1♀, USU).

MEXICO: **Baja California Norte:** Arroyo del Rosario (3 mi above El Rosario), H. B. Leech and PHA (1♀, CAS); Cataviña, WJP (2♂, CAS); 4.6 mi SE Colonet, DKF (1♂, SDNH); El Portezuelo (39 road mi S Cataviña), WJP (2♀, CAS); 8 mi NE El Rosarito (28°44'N, 113°56'W), WJP (1♀, CAS); 1–3 mi SE Santa Rosalillita (28°44'N, 114°08'W), WJP (1♀, CAS). **Baja California Sur:** 30 mi ESE Bahia Tortugas, WJP (1♂, CAS); La Paz, FXW (1♂, CAS); Los Barriles, MSW (3♀, 1♂, CAS, 13♀, 2♂, CSDA); 7.7 mi NE San Isidro, N. Bloomfield and DKF (1♂, SDNH). **Chihuahua:** 5 mi N Escalón, RMB (1♀, 1♂, UCD). Also: "Harry A. Hill collector, 15 July 1942" (1♀, SDNH).

Tachysphex arizonac Pulawski

(Figures 95, 96)

Tachysphex arizonac Pulawski, 1982:30, ♀, ♂.[1] Holotype: ♂, Arizona: Cochise Co.: 2 mi NE Portal (UCD).

DIAGNOSIS.—*Tachysphex arizonac* has well-defined mesopleural punctures, transversely oriented midscutal setae, and a horizontal depression at the apex of sternum I. The clypeal free margin of the female is either undulate, or with an obtuse, median projection (Fig. 95a). Females with an undulate clypeal margin are not easily separated from *lamellatus*, but a useful character is the hypostomal carina which is low in *arizonac*, but high in many *lamellatus*. The male of *arizonac* has a distinctive clypeus (Fig. 95b): the bevel is semilunate, the lobe forecorner is prominent (acutely in some specimens), and the lip of many specimens has an obtuse, median projection. The clypeus is somewhat similar in *texanus* and some *yolo*, but the vestiture is different. In *texanus*, mesopleural setae are appressed or nearly so beneath the scrobe (setae suberect in *arizonac*), and *yolo* has a nonvelvety sternal pubescence (sternal pubescence velvety in most *arizonac*).

DESCRIPTION (see also Table 2 under *texanus*, p. 123).—Punctures subcontiguous on scutum, but many discal punctures up to two to three diameters apart in females and many males; on vertex varying from about one to partly two to three diameters apart. Mesopleural punctures less than one diameter apart or (some specimens) about one diameter apart below scrobe. Propodeal dorsum irregularly rugose to evenly reticulate.

Vestiture obscuring integument between antennal socket and orbit. Setae about 1.3 MOD long on vertex; on scutum suberect, about 1.3 MOD long anterolaterally; suberect on hypoepimeral area.

Legs black, tarsal apex reddish; gaster all red (most specimens) to all black, in many specimens red with black, irregular spots. Terga I–IV (I–III in some females) silvery fasciate apically. Wings almost hyaline.

♀.—Clypeus (Fig. 95a): bevel as long as basomedian area or shorter; free margin of lip undulate, with obtuse, median projection, and also with obtuse, sublateral projection on each side (median projection in some specimens markedly larger than sublateral one). Dorsal length of flagellomere I 1.8–2.5× apical width. Vertex width scarcely more to scarcely less than length. Discal micropunctures of tergum II averaging two to three diameters apart. Tergum V densely punctate or punctures sparse mesally. Length 9.5–11.0 mm.

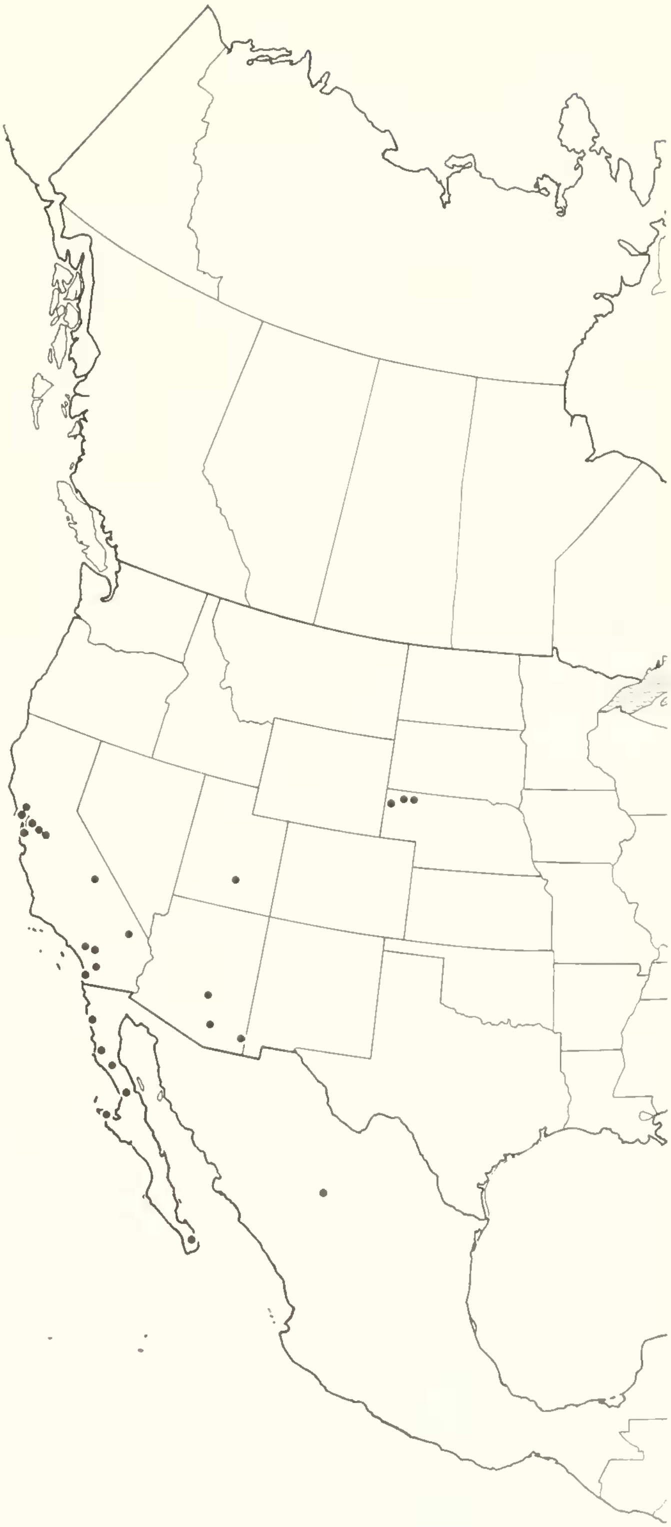

FIGURE 94. Geographic distribution of *Tachysphex huchiti* sp. n.

♂.—Clypeus (Fig. 95b): bevel semilunate, shallowly concave in some specimens; lip usually with obtuse projection mesally, but simply arcuate in some specimens; lobe forecorner prominent, mostly acute. Dorsal length of flagellomere I 1.3–1.9× apical width. Vertex width 1.2–1.3× length. Sterna evenly, mi-

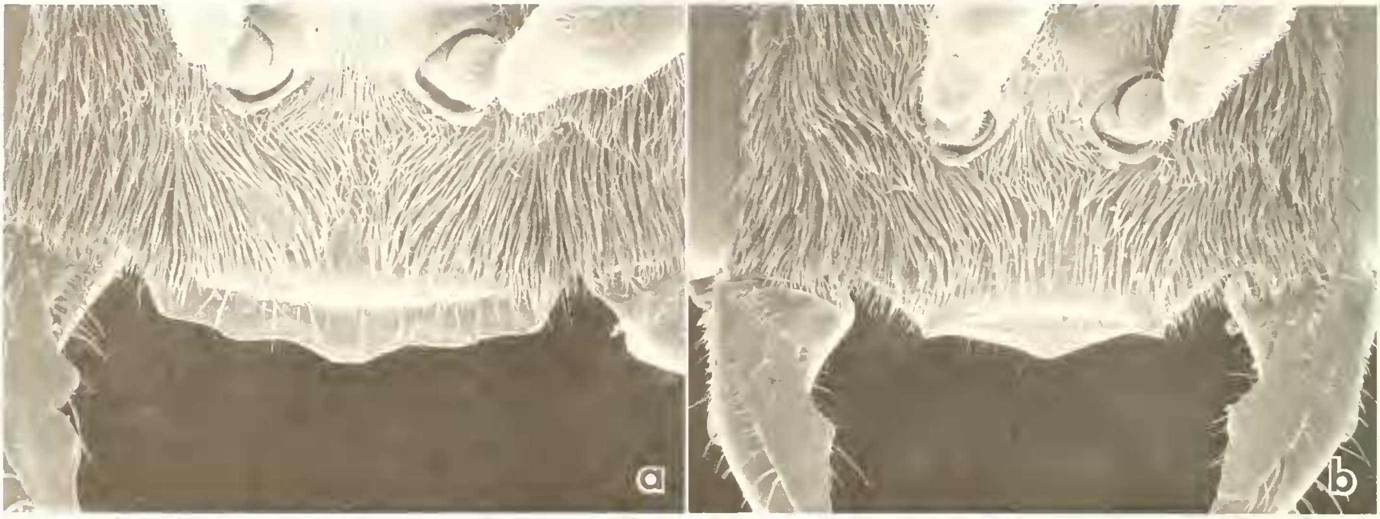

FIGURE 95. *Tachysphex arizonae* Pulawski: a—female clypeus; b—male clypeus.

nutely punctate (punctures less than one diameter apart), but sterna II–V apically impunctate, glabrous. Length 7–8 mm.

Sternal pubescence velvety but thin in many specimens in which the integument is easily visible.

GEOGRAPHIC DISTRIBUTION (Fig. 96).—Arizona, Utah, southern and central California, southern New Mexico, southwestern Texas, northern and central Mexico.

MATERIAL EXAMINED.—43♀, 33♂ (AMNH, ASU, CAS, CIS, CSDA, FSCA, LACM, NSDA, NYSU, SDNH, UAT, UCD, UCR, USNM, USU).

RECORDS.—UNITED STATES: ARIZONA: **Cochise:** 6 mi NE Apache, Elfrida, Huachuca Mts., 2 mi NE Portal. **Graham:** Roper Lake State Park (6 mi S Safford). **Maricopa:** Phoenix, 3 mi SW Wickenburg. **Pima:** Brown Canyon (Baboquivari Mts.), Santa Catalina Mts. (Molino Basin, Sabino Canyon), Santa Rita Mts. (Sycamore Canyon), Sierritas (31°56 N, 111°16 W), Tucson. **Santa Cruz:** Madera Canyon, Sycamore Canyon (Atascosa Mts.), Tumacacori Mts. **Yuma:** Mohawk (3 mi W Wellton). CALIFORNIA: **Imperial:** Experimental Farm. **Inyo:** Big Pine, Deep Springs. **Merced:** 2 air mi SE Mariposa Peak. **Riverside:** Upper Deep Canyon at Horsethief Creek. **San Diego:** Anza-Borrego Desert State Park (Grapevine Canyon), Descanso. **Stanislaus:** Del Puerto Canyon. NEVADA: **Clark:** Juanita Springs (10 mi S Riverside). NEW MEXICO: **Dona Ana:** Leasburg Dam State Park. TEXAS: **Brewster:** Big Bend National Park (Trap Spring, Tornillo Creek). UTAH: **Uintah:** SW Bonanza. **Washington:** Leeds Canyon, Rockville, Santa Clara, Snow Canyon, Toquerville, Zion National Park.

MEXICO: **Baja California Norte:** Cataviña. **Baja California Sur:** 4 mi WSW Miraflores. **Sinaloa:** 8 mi SE Elota. **Sonora:** Cocorit, La Aduana.

Tachysphex lamellatus Pulawski

(Figures 97, 98)

Tachysphex lamellatus Pulawski, 1982:32, ♀, ♂. Holotype: ♂, Mexico: Sonora: Alamos (CAS, Type #13465).

DIAGNOSIS.—*Tachysphex lamellatus* has a punctate mesopleuron, the midscutal setae are transversely oriented, and sternum I has a horizontal depression apically. The male has a triangular or subtriangular clypeal lip (Fig. 97b) and a nondentate inner mandibular margin (Fig. 97b). All these characters are identical in males of *huchiti* and *sonorensis*. In *lamellatus*, however, scutal setae are nearly erect, 1.3 MOD long anterolaterally, and flagellomeres I–III are the usual length, whereas in *huchiti* scutal setae are subappressed, shorter than MOD, and in *sonorensis* flagellomeres I–III are shortened. The female of *lamellatus* has a distinctive, undulate clypeal lip (Fig. 97a), but many *arizonae* have the same clypeus, and such individuals cannot be separated with certainty from *lamellatus*. Two characters help in recognition of *lamellatus*: the hypostomal carina is unusually high in some females and most males (as it is in *paiute*), and the gena adjacent to the hypostoma is ridged in most males (Fig. 97c). Such ridges have not been found in any other *Tachysphex*.

DESCRIPTION (see also Table 2 under *texanus*, p. 123).—Scutal punctures less than one diameter apart on scutum, but many punctures of disk two to three diameters apart in some females. Mesopleural punctures varying from about one to two or three diameters apart below scrobe. Propodeal dorsum irregularly rugose to evenly reticulate, side punctate in some males.

Vestiture concealing sculpture between antennal socket and orbit.

Legs black, tarsal apex brown. Gaster red, but tergum I black in male from Atascosa Mountains, Arizona, and terga V–VII and all sterna largely black in male from Sabino Canyon, Arizona. Terga I–IV (I–III in some females) silvery fasciate apically. Wings almost hyaline.

♀.—Clypeus (Fig. 97a): bevel about as long as basomedian area; free margin of lip undulate, with obtuse, median projection, and one obtuse, sublateral projection on each side. Dorsal length of flagellomere I 2.0–2.4 × apical width. Vertex width scarcely more to scarcely less than length. Vertex punctures varying from less than one to mainly two or three diameters apart. Discal micropunctures of tergum II varying from about one to two or three diameters apart. Tergum V densely punctate or punctures sparse mesally. Length 7.0–9.5 mm.

Setal length 1.0–1.3 MOD on vertex and anterolaterally on scutum; scutal setae subappressed or erect.

♂.—Clypeus (Fig. 97b): free margin not angulate or scarcely angulate between lip and lateral section; lip obtusely angulate, but rounded in some small individuals; distance between corners more than to less than distance between corner and corresponding orbit. Dorsal length of flagellomere I 1.0–1.3 × apical width. Vertex width 1.3–1.6 × length. Sterna evenly, minutely punctate (punctures less than one diameter apart) except impunctate, glabrous apically. Length 5–8 mm.

Setal length (in MOD): 1.0–1.3 on vertex; 1.3 on scutum anterolaterally (setae suberect); 1.5–2.0 on mesopleuron (setae suberect). Sternal setae velvety but thin, integument easily visible.

Variation.—The hypostomal carina is lamelliform in most specimens (Fig. 97c), two to several times higher than the occipital carina dorsally, forming an acute angle with the adjacent gena, but the carina is the usual form (as high as occipital carina dorsally) in many Arizona females, a single female from Cajon, California, a single female from Valle de Mazapa, Mexico, one of the males from Ramsey Canyon, Arizona, and two males found 3 mi SE Petlalcingo, Mexico.

In most males the gena is irregularly ridged adjacent to the hypostomal carina (Fig. 97c); the ridges are coarse in Mexican and some Arizona individuals, moderate or fine in most Arizona individuals, and absent in specimens from California, some from Arizona, and two males found 3 mi SE Petlalcingo, Mexico. All three conditions occur in males from Portal, Arizona.

Geographic Distribution (Fig. 98).—New Mexico to southern California, north to southwestern Utah, Mexico.

Material Examined.—150♀, 80♂ (CAS, CIS, CNC, FSCA, KU, NYSU, TLG, UAT, UCD, UCR, UIM, UMMZ, USNM, USU).

Records.—UNITED STATES. ARIZONA. **Cochise:** Paradise, Portal (also 5 mi S, 5 mi W, 5 mi SW), Ramsey Canyon (Huachuca Mts.). **Gila:** Gila River 3 mi SW Christmas. **Maricopa:** Gila River 7 mi S Buckeye. **Mohave:** Wikieup. **Pima:** Baboquivari Mts. (Brown Canyon, Elkhorn Ranch), Madrona Ranger Station (Rincon Mts.), Santa Catalina Mts. (Molino Camp, Sabino Canyon), Santa Rita Mts. (Madera Canyon, Sycamore Canyon), Tucson (also 5 mi N). **Pinal:** Superior (Boyce Thompson Arboretum). **Santa Cruz:** Atascosa Mts., Patagonia (also 12 mi SW), Santa Rita Mts. (Florida Canyon, Madera Canyon), Sycamore Canyon (Tumacacori Mts.). **Yavapai:** Irving Power Station (W Strawberry), Prescott. CALIFORNIA. **Inyo:** Darwin Falls. **Orange:** Laguna Canyon. **San Bernardino:** Cajon Pass, Mid Hills (9 mi SSE Cima). NEW MEXICO: **Catron:** Glenwood. **Luna:** 6 mi NW Florida. UTAH: **Washington:** Leeds Canyon, Zion National Park (Birch Canyon).

MEXICO. **Chiapas:** Valle de Mazapa. **Chihuahua:** 6 mi S Encinillas. **Hidalgo:** Jacala. **Puebla:** 3 mi NW Petlalcingo (also 3 mi SE). **Sinaloa:** 9 mi E Chupaderos, 54 mi S Culiacán. **Sonora:** Alamos, La Aduana. **Tres Marias Island:** Maria Magdalena Island

Tachysphex tsil sp. n.

(Figures 99, 100)

Derivation of Name.—Tsil is an Apache word for mountain; noun in apposition. An allusion to the Chiricahua Mountains where the holotype was collected (the name of this range is derived from the Apache words tsil, mountain, and kawa, great).

Diagnosis.—*Tachysphex tsil* has well-defined mesopleural punctures, midscutal setae oriented laterad or posterolaterad, and an apical depression on sternum I. Several other species share these characters, but the male of *tsil* has a distinctive clypeus (Fig. 99): the lip is markedly sinuate, and the distance between its corners equals 0.7–0.8 of the clypeal length (greater than clypeal length in other species). In the female, mesopleural punctures average more than one diameter apart beneath the scrobe. This condition is also found in *sonorensis* and some *lamellatus*. The female of *lamellatus* can be recognized by its distinctive, undulate clypeal lip (Fig. 97a), and most specimens have an unusually high hypostomal carina (Fig. 97c). Females of *tsil* and *sonorensis* apparently are inseparable, differing only in size (8.0–8.5 mm in *tsil*, 9–11 mm in *sonorensis*). The geographic ranges help in their identification: both occur in Mexico, but *tsil* ranges north into Arizona and Oklahoma, while *sonorensis* ranges from Costa Rica to North Dakota and Oregon. Furthermore, *tsil* is an uncommonly collected species.

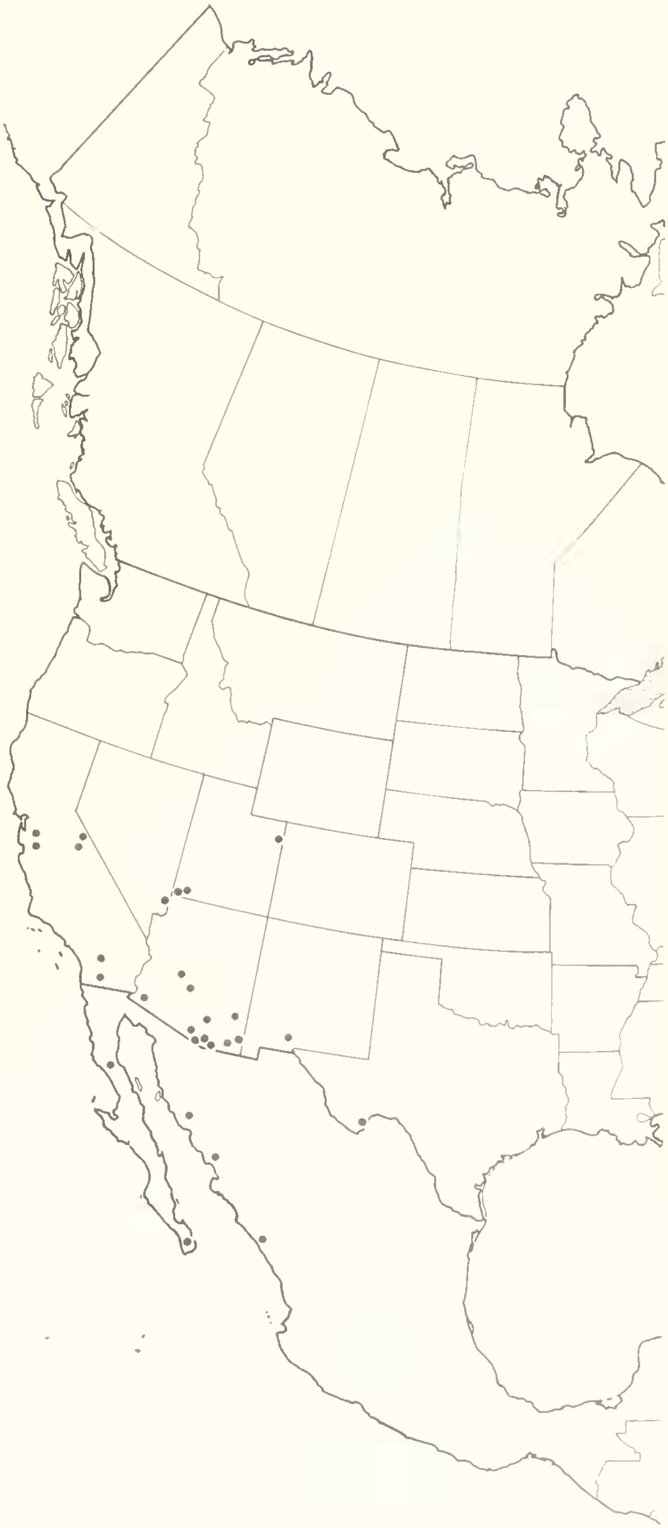

Figure 96. Geographic distribution of *Tachysphex arizonac* Pulawski

Description (see also Table 2 under *texanus*, p. 123).—Punctures almost contiguous on scutum in most specimens, but many

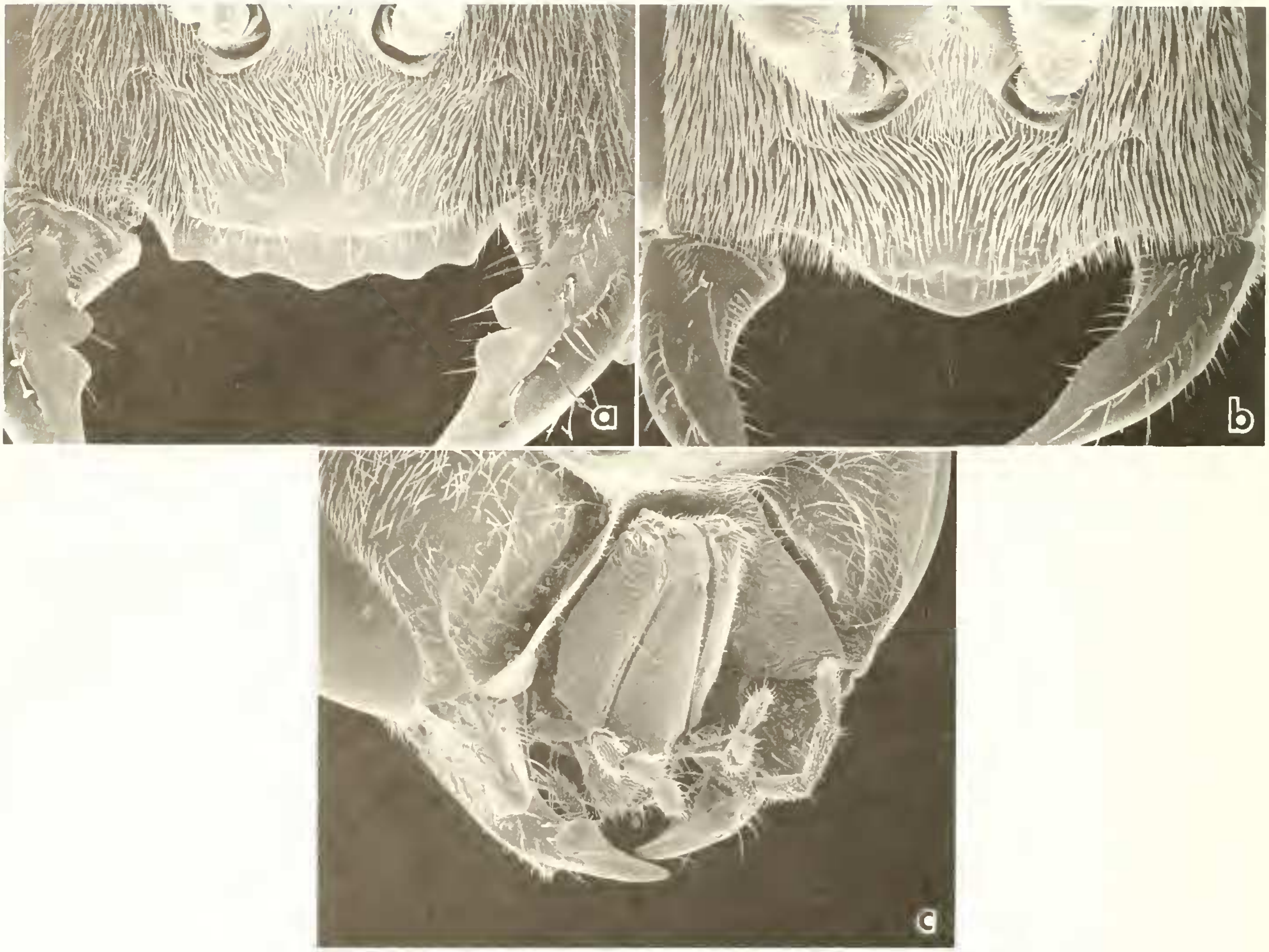

FIGURE 97. *Tachysphex lamellatus* Pulawski: a—female clypeus, b—male clypeus; c—male mouthparts and adjacent areas.

diameters apart on each side of median zone in the single female from Oklahoma; on vertex unevenly distributed, subcontiguous to two or three diameters apart, on mesopleuron averaging more than one diameter apart below scrobe in females and most males (one diameter in the single male from Kingman area, Arizona) and most males. Propodeal dorsum rugose.

Vestiture not totally obscuring integument between antennal socket and orbit. Setae 1.0–1.4 MOD long on vertex; on scutum erect (1.3 MOD long) to nearly appressed (1.0 MOD long) anterolaterally, erect on hypoepimeral area.

Legs black, tarsal apex reddish; gaster red. Terga I–III or I–IV silvery fasciate apically. Wings almost hyaline.

♀.—Clypeus: bevel about as long as basomedian area; lip varying: evenly arcuate, obtusely pointed, or obtusely prominent mesally and sublaterally (free margin undulate). Dorsal length of flagellomere I 2.0–2.2 × apical width. Vertex width 1.0–1.25 × length. Discal micropunctures of tergum II averaging one to three diameters apart. Tergum V sparsely punctate. Length 8.0–8.5 mm.

♂.—Clypeus (Fig. 99): distance between lip corners 0.7–08 of clypeal length and about 0.6 of distance between corner and orbit; lip with obtuse median prominence, its forecorner prominent, acute (free margin markedly sinuate). Dorsal length of flagellomere I 1.3–1.5 × apical width. Vertex width 1.15–1.4 × length. Sterna evenly, minutely punctate (punctures less than one diameter apart), but sterna II–VI apically impunctate, glabrous. Length 6.0–7.0 mm.

Sternal pubescence velvety.

DISCUSSION.—Females of *tsil* and *sonorensis* are indistinguishable, and my association of sexes in *tsil* is based on the following: (1) males and females have identical basic structures such as mesothoracic sculpture and vestiture and the shape of sternum I, and (2) both females and males were collected together in certain localities where *sonorensis* has not been found (e.g., in Portal area, Arizona, Black Mesa State Park, Oklahoma, or near Perote, Mexico).

GEOGRAPHIC DISTRIBUTION (Fig. 100).—Known from Arizona, Oklahoma panhandle, as well as Jalisco, Morelos, and Veracruz states in Mexico.

COLLECTING PERIOD.—24–29 February, 6 and 14 March

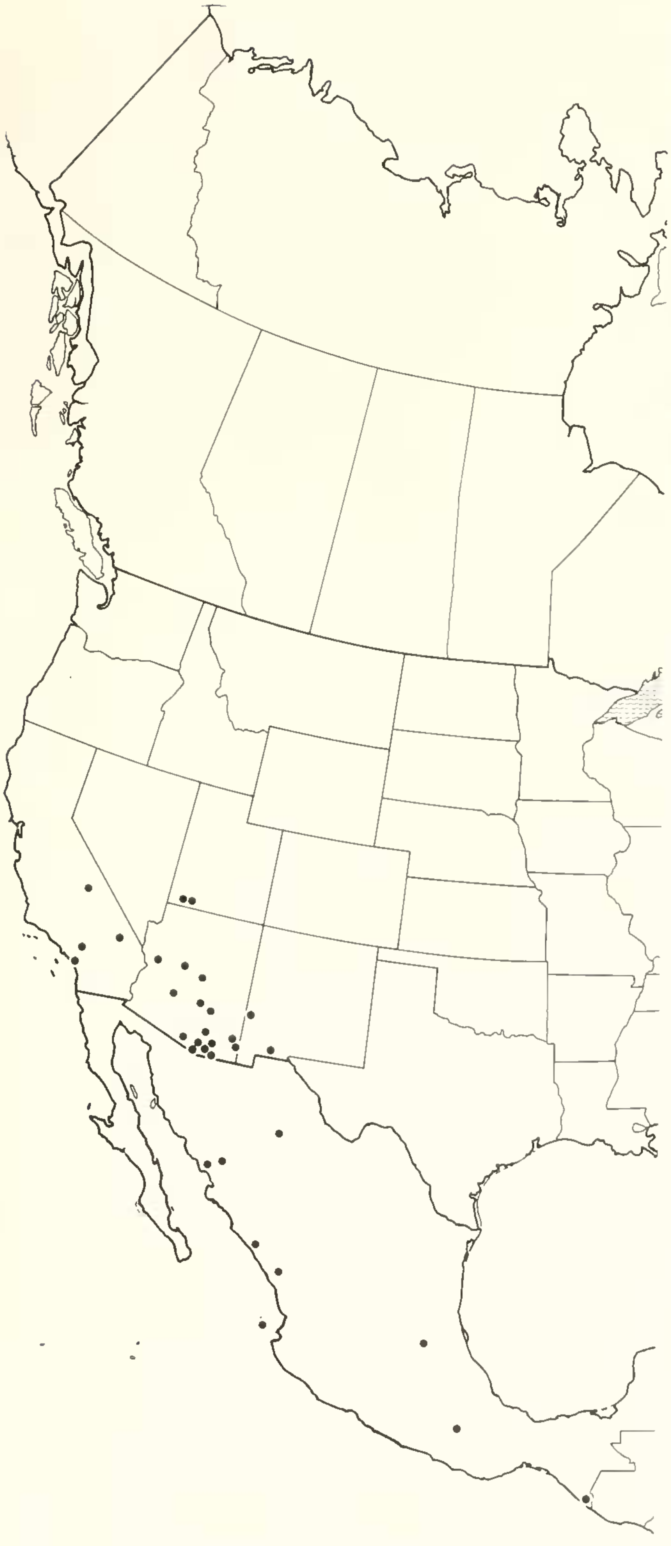

FIGURE 98. Geographic distribution of *Tachysphex lamellatus* Pulawski.

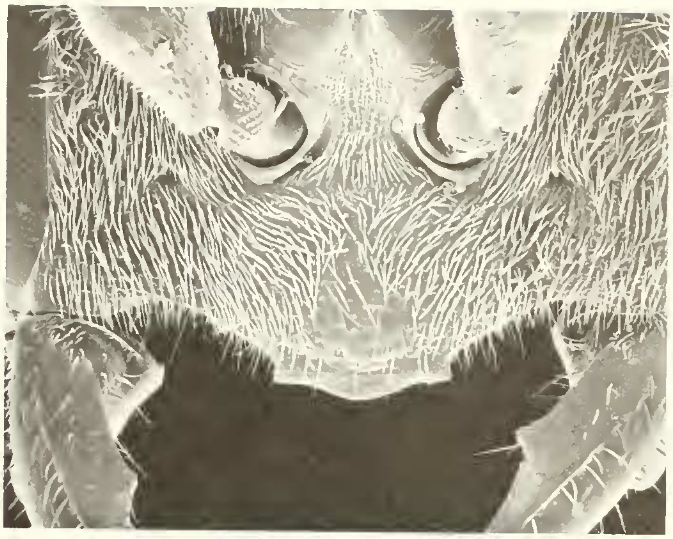

FIGURE 99. *Tachysphex tsil* sp. n.: male clypeus.

(Mexico); 12 March (Kingman area, Arizona); 5–20 May, 29 June, 7 September to 28 October (remaining Arizona localities and Oklahoma).

MATERIAL EXAMINED.—Holotype: ♂, Arizona: Cochise Co.: 5 mi W Portal, Southwestern Research Station, 6 October 1966, PHA (CAS, Type #14161).

Paratypes (7♀, 14♂): UNITED STATES: ARIZONA. **Cochise:** Hidden Terrace in Chiricahua Mts., 4.5 mi W Portal, M. Cazier (1♀, AMNH); 5 mi W Portal, Southwest Research Station, J. G. Rozen (2♀, AMNH, CAS), V. Roth (1♀, AMNH), M. Statham (1♂, UCD); 6 mi W Portal, A. L. Steiner (1♀, 1♂, UAE; 1♂, CAS). **Maricopa:** 3 mi SW Wickenburg, P. Torchio and GEB (2♂, UCD, USU). **Mohave:** 8 mi N Kingman, P. Torchio and B. Appleton (1♂, USU). **Pima:** Sabino Canyon, JWMS (1♂, CIS). OKLAHOMA. **Cimarron:** Black Mesa State Park, WJP (1♀, 1♂, CAS).

MEXICO: **Jalisco:** Laguna de Moreno, RCB and EIS (2♂, CAS, UCD). **Morelos:** 3 and 4 mi N Cuernavaca, HEE (2♂, CU). **Veracruz:** 5 mi SW Perote, FDP and D. Miller (1♂ CAS; 1♀, 1♂, USU).

Tachysphex sonorensis (Cameron)

(Figures 101, 102)

Larra sonorensis Cameron, 1889:50, ♀. ! Holotype: ♀, Mexico: northern Sonora: no specific locality (BMNH).—In *Tachysphex*: Bohart and Menke 1976:276; Krombein 1979:1629, Rust et al. 1985:46, 53; Parks 1986:34.

Tachysphex dakotensis Rohwer, 1923:98, ♀. ! Holotype: ♀, North Dakota: Bowman Co.: Gascoyne (USNM). Synonymized by Pulawski *in* Krombein 1979:1629.—G. Bohart 1951:951, Bohart and Menke 1976:273.

Tachysphex schlingeri R. Bohart, 1962:36, ♂, ♀. ! Holotype: ♂, California: Sierra Co.: Sierraville (CAS). Synonymized by Pulawski *in* Krombein 1979:1629.—Krombein 1967:393, Bohart and Menke 1976:276.

DIAGNOSIS.—*Tachysphex sonorensis* has well-defined mesopleural punctures, the midscutal setae oriented transversely or posterolaterad, and sternum I has a well-defined, horizontal depression apically. *Tachysphex texanus, huchiti, yolo,* and *yuma* are similar, but in *sonorensis* the mesopleural punctures average more than one diameter apart below the scrobe (Fig. 101a, b), and the setae are almost erect on the scutum and hypoepimeral area. The females of *sonorensis* and *tsil* are identical morphologically, but they differ in size and their geographic ranges help in identification (see *tsil* for details). *Tachysphex amplus, arizonac,* and *lamellatus* are also similar, but their clypeus is distinctive (see these species for other differences). The male of

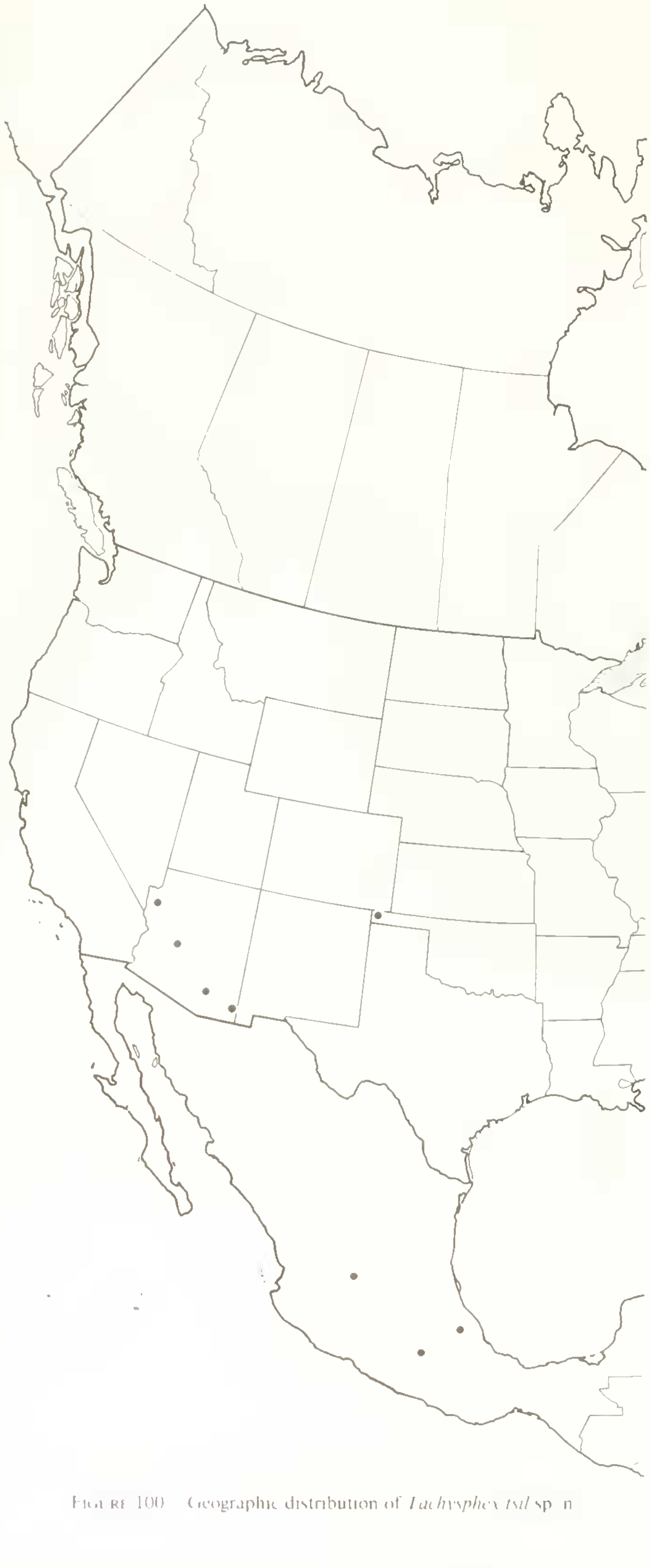

FIGURE 100. Geographic distribution of *Tachysphex tsil* sp. n.

sonorensis has a distinctive flagellum (Fig. 101e): flagellomeres I–III shortened, I about as long ventrally as pedicel, III about 0.75 length of IV. Additional recognition features in the male are: clypeal lip triangular (Fig. 101c), inner mandibular margin not dentate (Fig. 101d), forebasitarsus with preapical rake spines (rudimentary in some individuals), and sternal pubescence not velvety.

DESCRIPTION (see also Table 2 under *texanus*, p. 123).—Vertex and mesothorax punctate. Mesopleural punctures averaging more than one diameter apart below scrobe (Fig. 101a, b). Propodeal dorsum areolate or rugose.

Setae 1.0–1.1 MOD long on vertex; erect on hypoepimeral area, suberect to subappressed below mesopleural scrobe.

Legs black, tarsal apex brown or reddish. Gaster red (most specimens) to black. Terga I–III or I–IV silvery fasciate apically. Wings weakly infumate to almost hyaline.

♀.—Clypeus: bevel triangular, as long mesally as basomedian area or longer; lip arcuate or weakly undulate. Dorsal length of flagellomere I 1.8–2.2× apical width. Vertex width equal to length or slightly more; punctures one to two diameters apart. Most scutal punctures usually several diameters apart on each side of mesal zone, but one to two diameters apart in some specimens. Discal micropunctures of tergum II at least two diameters apart. Punctures of tergum V two to four diameters apart mesally. Length 9–11 mm.

Scutal setae suberect, 0.8–0.9 MOD long anterolaterally.

♂.—Clypeus (Fig. 101c): bevel delimited laterally by short, longitudinal carina that extends from lip corner; lip triangular, its corners rounded, closer to each other than to orbit or equidistant. Dorsal length of flagellomere I 0.9–1.1× apical width, ventral length equal to pedicellar venter or slightly less (Fig. 101e); length of flagellomere III about 0.75 of IV. Vertex width 1.4–1.7× length. Vertex punctures one to three diameters apart. Scutal punctures (some specimens) less than one diameter apart or (most specimens) many discal punctures one to three diameters apart. Sterna evenly, minutely punctate (punctures less than one diameter apart) except sterna II–V apically impunctate, glabrous. Outer margin of foretarsomere I with two to five preapical spines whose length may exceed tarsomere width. Length 6–10 mm.

Scutal setae erect, 0.9–1.0 MOD long. Sternal pubescence not velvety, integument easily visible.

VARIATION.—The gaster varies from all red to all black. The black form occurs mainly in mountains; it was described as *dakotensis* by Rohwer (1923) and as *schlingeri* by R. Bohart (1962). On Santa Rosa Island, California, the gaster is all red in females and all black in males. The gaster is red in both sexes on Santa Cruz Island.

GEOGRAPHIC DISTRIBUTION (Fig. 102).—Alberta, North Dakota and Oregon to Panama.

MATERIAL EXAMINED.—235♀, 289♂.

RECORDS (b: gaster all black).—CANADA: **Alberta:** Drumheller (b).

UNITED STATES: ARIZONA: **Cochise:** 15 mi SW Apache, 17 mi E Douglas (also 20 mi N), Hereford. **Maricopa:** Phoenix, Tempe. **Mohave:** Kingman. **Pima:** Organ Pipe Cactus National Monument. **Santa Cruz:** Nogales. **Yavapai:** 8 mi NE Yarnell. CALIFORNIA: **Alpine:** Hope Valley (b), Winnemucca Lake. **Contra Costa:** Danville, Moraga. **El Dorado:** 5–6 mi NE on Icehouse road (24 air mi ENE Placerville—b), Lake Fontanillis, 8,500 ft (b), South Lake Tahoe (b). **Fresno:** Firebaugh, Fresno. **Humboldt. Imperial:** —. **Inyo:** Bishop (also 15 mi N), Deep Springs, 2 mi S Lone Pine. **Kern:** Mill Potrero, 13 mi S Shafter. **Lassen:** Bridge Creek Camp, Hallelujah Junction (b). **Los Angeles. Marin. Mendocino. Merced:** Dos Palos, George J. Hatfield State Park. **Modoc:** Lake City. **Mono. Monterey:** Asilomar, Pacific Grove. **Nevada:** Boca (partly b), Sagehen Creek near Hobart Mills (partly b). **Orange. Placer:** 4 mi S Rocklin. **Riverside:** Anza, Calimesa, Temecula. **San Bernardino:** Hole-in-the-Wall (Providence Mts.), Saratoga Springs, 3 mi SE Yucaipa. **San Diego. San Francisco:** San Francisco (Lone Mountain). **San**

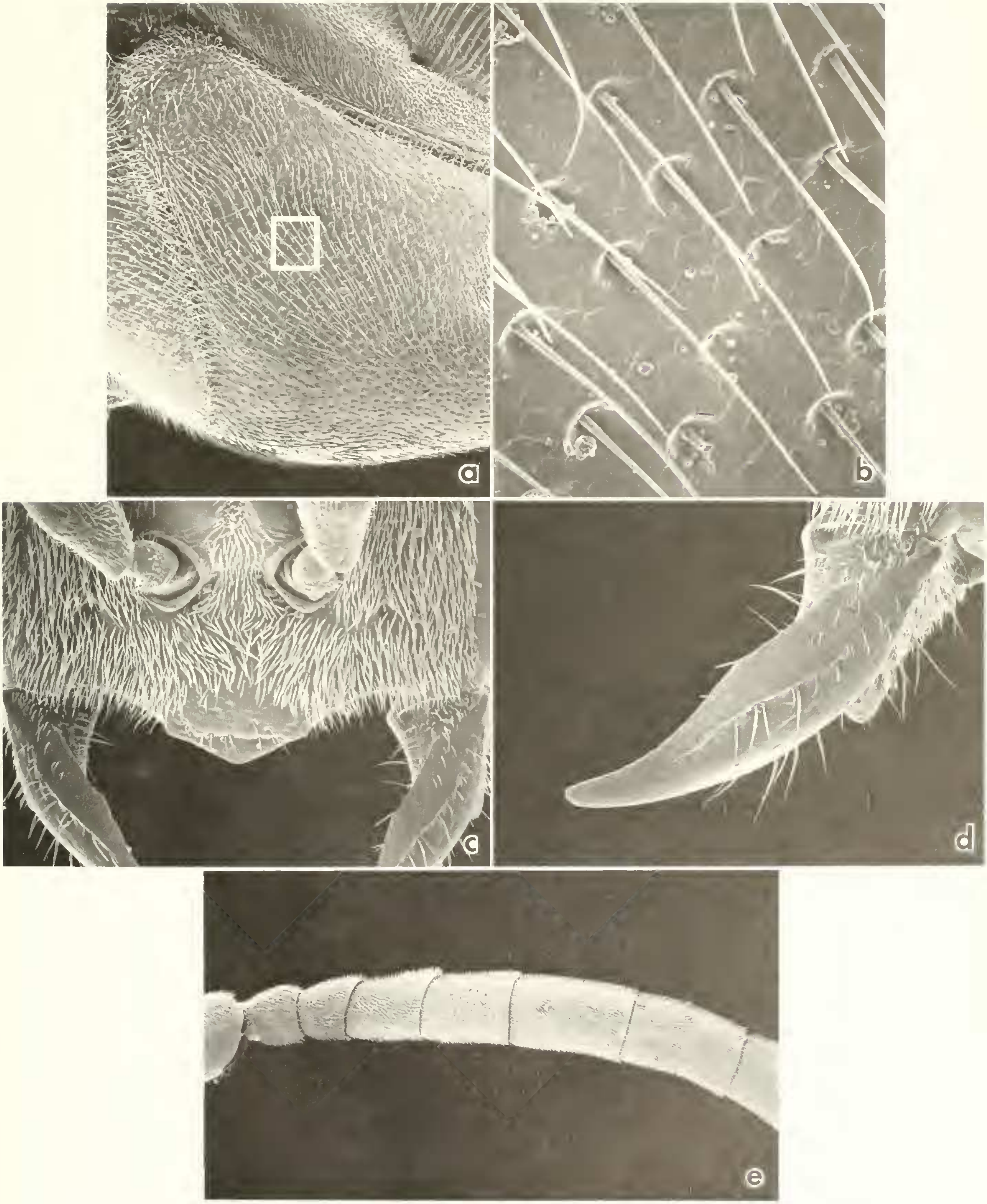

FIGURE 101. *Tachysphex sonorensis* (Cresson): a—female mesopleuron (box area shown in b); b—mesopleural punctures shown in box of a; c—male clypeus; d—male mandible; e—male antenna.

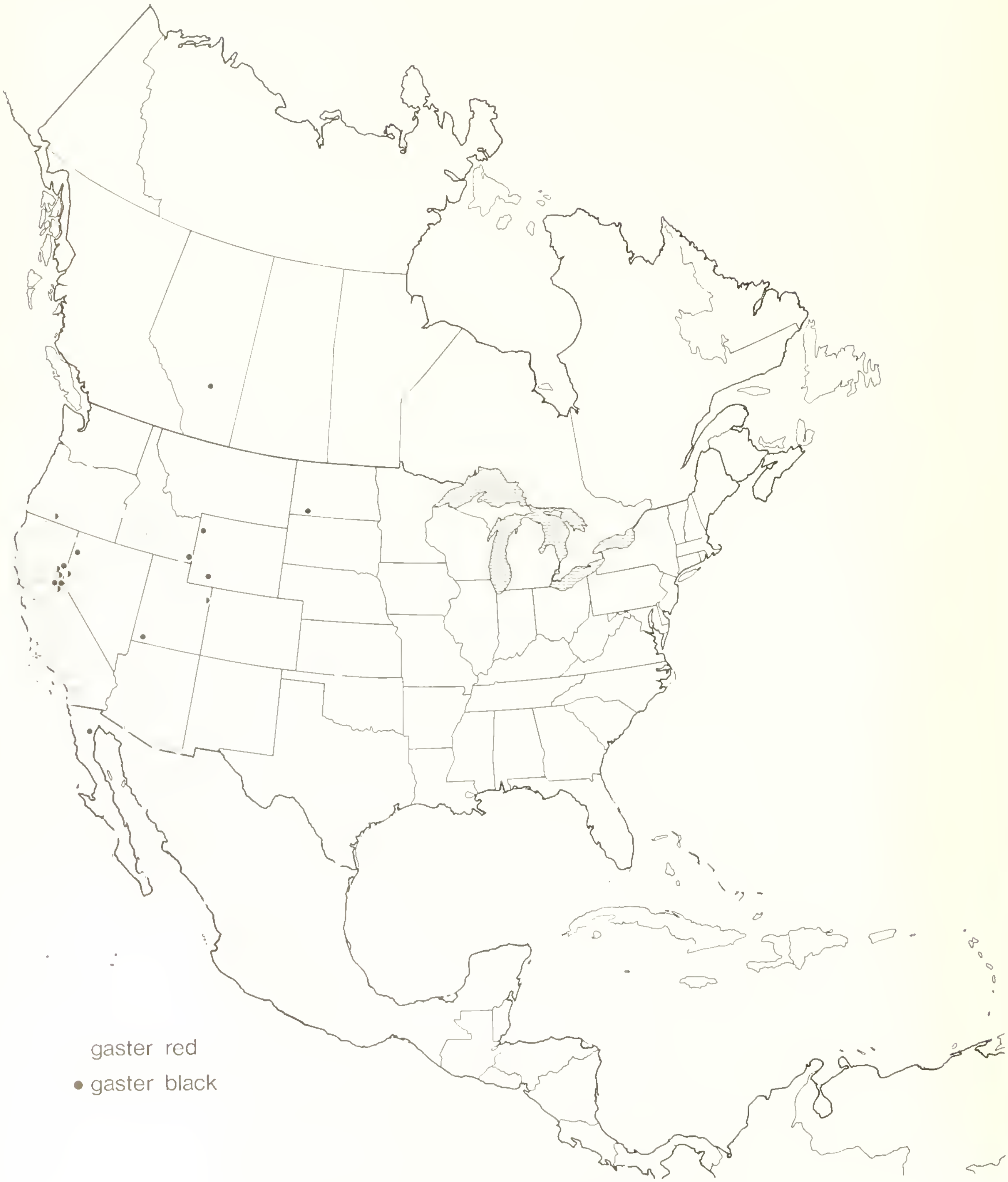

Figure 102. Geographic distribution of *Tachysphex sonorensis* (Cresson).

Joaquin: Corral Hollow (8 mi SW Tracy). Hospital Canyon. Weston. **San Luis Obispo. San Mateo:** Half Moon Bay (also 12 mi N). Redwood Canyon, Redwood City. **Santa Barbara:** including Santa Cruz Island and Santa Rosa Island. **Santa Clara:** Croy road. San Jose, Stanford University. **Shasta:** Redding. **Sierra:** Independence Lake (partly b), Sardine Creek ca. 1 mi NW Bassets (partly b). Sattley. Sierraville (partly b). **Siskiyou:** Bull Meadow, Etna, Klamath River 8 mi N Yreka. **Solano:** Putah Creek. **Sonoma. Stanislaus:** Modesto, Newman. **Tehama:** Colyear Springs Road. **Trinity:** Cedar Creek. **Tulare:** Woodlake. **Tuolumne:** Dodge Ridge near Strawberry (R. Bohart 1962—b). Don Pedro Reservoir (9 air mi W Coulterville). Leland Meadow. **Ventura. Yolo:** Davis. COLORADO: **Larimer:** Masonville. IDAHO: **Bear Lake:** Montpelier (b). **Butte:** Craters of the Moon National Monument. **Canyon:** 2 mi N Melba, Parma. **Elmore:** 3 mi SE Mt. Home. **Gooding:** 1 mi NE Gooding. **Lincoln:** Owinza Hot Springs. **Twin Falls:** Rogerson. KANSAS: **Barber:** 2.5 mi S Aetna, 16 mi W Hardtner. NEVADA. **Churchill:** Fallon. **Clark:** Overton. **Elko:** Wild Horse. **Humboldt:** Orovada. **Lyon:** Fernley. **Washoe.** NEW MEXICO. **Dona Ana:** Leasburg Dam State Park. **Luna:** 17 mi E Deming. **Otero:** Alamogordo. **Torrance:** Moriarty. NORTH DAKOTA. **Bowman:** Bowman, Gascoyne (b). OREGON. **Curry:** Brookings, 6–10 mi E along Winchuck River. **Klamath:** Lower Klamath Lake (partly b). **Sherman:** Rufus. TEXAS: **Bexar, Bosque:** —. **Hidalgo:** McAllen Botanical Garden. UTAH. **Cache:** Cornish, Green Canyon, Smithfield. **Millard:** Delta. **Uintah:** SW Bonanza (partly b). **Washington:** 1 mi W Leeds, Leeds Canyon. WYOMING. **Sweetwater:** Green River (R. Bohart 1962—b). **Teton:** Moran (b).

MEXICO: **Baja California Norte:** Arroyo Grande (39 mi SW La Ventana—b), Ensenada, Rio San Miguel (La Misión), Salsipuedes, 10 and 40 mi S San Quintin, 5mi S Santa Maria. **Baja California Sur:** La Paz, 6 mi S San Juanico, San Pedro. **Chihuahua:** 10 mi S Jiménez, Matachic. **Jalisco:** Estanzuela (40 km W Ameca), 25 mi N Guadalajara. **Puebla:** 7 mi NE Atlixco, 25 mi SE Puebla. **Sinaloa:** 19 mi S Villa Unión. **Sonora:** Alamos, Guaymas, Navajoa, 8 mi S Santa Rita.

CENTRAL AMERICA. COSTA RICA. **Guanacaste:** Rio Corbici near Cañas. PANAMA: El Volcan Chiriqui.

Tachysphex papago Pulawski

(Figure 104)

Tachysphex papago Pulawski, 1982.35, ♀, ♂. ! Holotype: ♀, Arizona: Santa Cruz Co.: Nogales (BMNH).

DIAGNOSIS.—*Tachysphex papago* has a short malar space (rudimentary in some specimens), a punctate mesopleuron, and terga I and II are microsculptured and ciliate but contrastingly unsculptured and glabrous apicomesally. These characters are shared with *psilocerus* and *scopaeus*, but the upper metapleuron is simple in *papago*, and the metapleural flange is narrow (in the other two, the upper metapleuron is variously modified, and the flange is broad). In addition, the propodeal dorsum and side are punctate in *papago*, the basal (oriented posterad) setae of the propodeal dorsum extend almost from spiracle to spiracle, and the female flagellum is largely brown or red (these characters also occur in *psilocerus*). A subsidiary diagnostic feature is the presence of erect setae on the midfemoral venter (setae about 1.0 MOD long).

DESCRIPTION.—Malar space about 0.4 MOD long. Frons opaque, punctate, or punctatorugose. Punctures: averaging less than one diameter apart on frons, several diameters apart on vertex and mesothoracic venter; about one to several diameters apart on scutal disk; about one diameter apart or more on mesopleuron. Metapleuron punctate, upper metapleuron simple. Propodeum opaque, dorsum and side punctate (except side impunctate basally); dorsal punctures subcontiguous, interspaces in the form of minute, irregular, longitudinal ridges; side punctures averaging about one diameter apart, interspaces finely, longitudinally ridged; hindface punctate and irregularly, transversely ridged. Tergal micropunctures dense, but more than one diameter apart on disk of tergum II; terga I and II unsculptured apicomesally. Hindcoxa not carinate.

Setae erect on vertex and midfemoral venter, about 1.0 MOD long; scutal setae suberect, about 1.0 MOD long anterolaterally. Vestiture not concealing sculpture, except (when viewed from certain angles) between antennal socket and orbit and on basal half of propodeal dorsum. Setae of propodeal dorsum oriented anterad except oriented posterad on broad, basal zone that extends nearly from spiracle to spiracle.

Wings uniformly, moderately infumate to almost hyaline.

♀.—Clypeus: bevel longer than basomedian area; lip straight, obtusely produced mesally, but incised laterally. Dorsal length of flagellomere I 2.6–2.7× apical width. Vertex width about 1.4× length. Sternum I without apical depression or concavity. Apical depression of tergum V alutaceous, impunctate. Pygidial plate minutely punctate, interspaces smooth. Length 7 mm.

Body black, but the following red brown: mandible, clypeal lobe, antenna (except pedicel, flagellomere I basally, in some specimens also apical three flagellomeres), foretibia largely, midtibia, and all tarsi partly. Tergum I not fasciate, terga II and III fasciate apically (fasciae interrupted mesally).

♂.—Clypeus: lobe obtusely pointed, lip corners indistinct but slightly closer to each other than to orbits. Dorsal length of flagellomere I 1.4–1.5× apical width. Vertex width 1.6–1.8× length. Forebasitarsus without rake; outer apical spine of foretarsomere II about as long as tarsomere width. Forefemoral notch glabrous. Length 5.3–6.3 mm.

Body black except mandible reddish mesally. Terga I–IV fasciate apically (fasciae interrupted).

GEOGRAPHIC DISTRIBUTION (Fig. 104).—Southern Arizona.

MATERIAL EXAMINED.—3♀, 2♂ (BMNH, NYSU, UAE, WJP).

RECORDS.—ARIZONA. **Cochise:** 5 mi W Portal (also 6 mi W). **Santa Cruz:** Nogales

Tachysphex scopaeus sp. n.

(Figures 103, 104)

DERIVATION OF NAME.—Scopaeus is derived from the Greek word skopaios, a dwarf; noun in apposition.

DIAGNOSIS.—*Tachysphex scopaeus* shares with *papago* and *psilocerus* a short malar space (rudimentary in some specimens), punctate mesopleuron, and a characteristic sculpture of terga I and II (microsculptured and ciliate but contrastingly unsculptured and glabrous apicomesally; Fig. 103e). However, *scopaeus* has a rugose propodeal dorsum and a ridged propodeal side (propodeal dorsum and side punctate in the other two); the posterad oriented setae on the propodeal dorsum are inconspicuous and present only basomedially (rather than extending almost from spiracle to spiracle); the hindcoxa has an expanded, toothlike carina dorsally (hindcoxa not carinate); and the male flagellomere III is about as long as 0.75 of flagellomere IV (0.9 of IV in the other two). In *scopaeus*, but also in *psilocerus*, the metapleural flange is broad (Fig. 103c, d), and the upper metapleuron is modified (the only two such cases in the *pompiliformis* group). The modifications are not identical: in *scopaeus*, there is an oblique lamella beneath the anterior end of the flange (Fig. 103c, d), and one or two longitudinal ridges behind the lamella (the ridges end before the propodeal spiracle). See *papago* and *psilocerus* for additional differences.

DESCRIPTION.—Malar space (Fig. 103b) about 0.5–0.8 MOD long. Frons with conspicuous microsculpture and shallow punc-

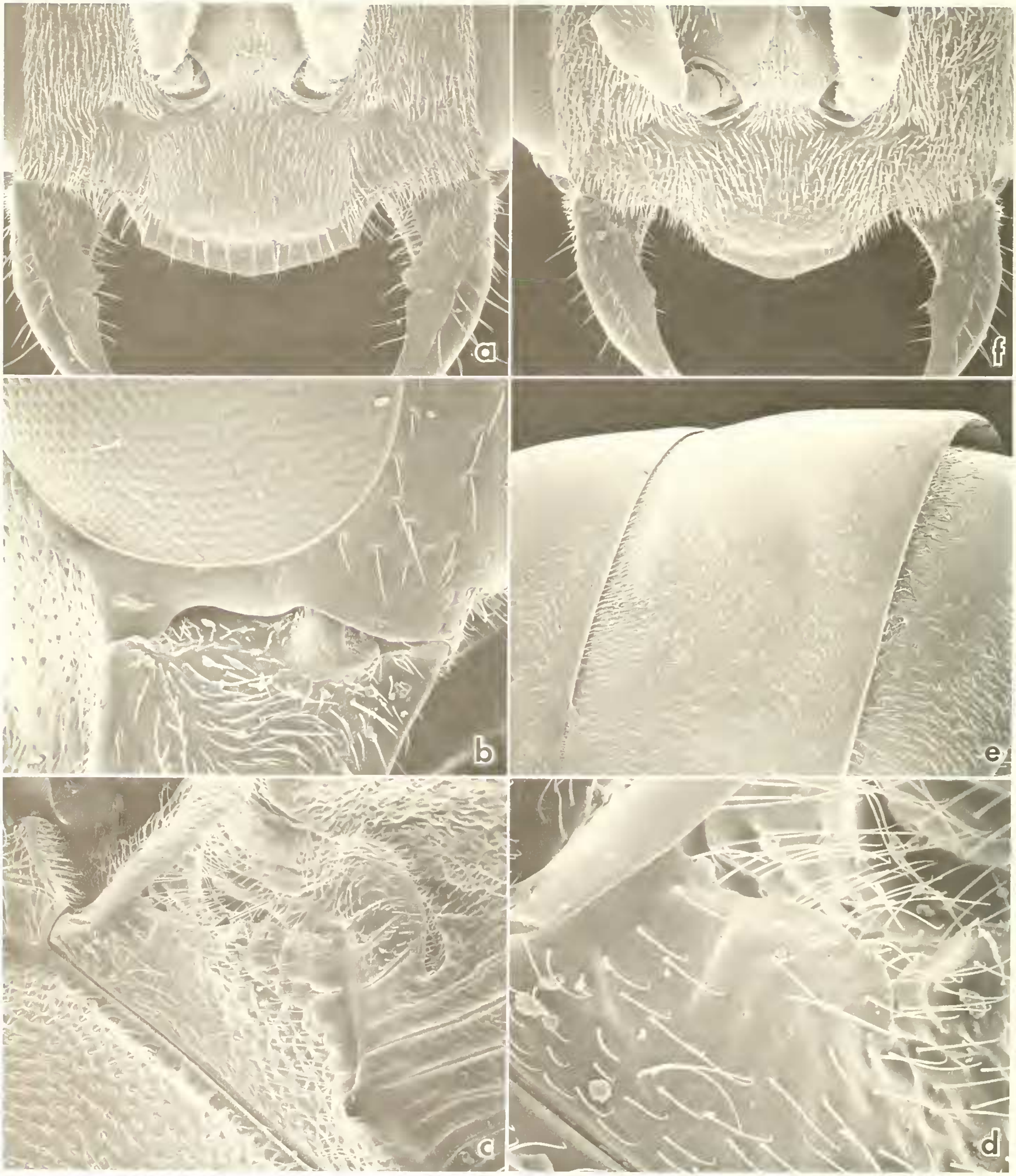

FIGURE 103. *Tachysphex scopaeus* sp. n. a—female clypeus; b—malar space of female; c—upper metapleuron of female; d—oblique carina indicated by an arrow in c; e—female terga I-III; f—male clypeus.

tures that average up to one or two diameters apart. Vertex punctures one to many (female) or one to two (male) diameters apart. Scutal punctures varying from about one (males, some females) to many diameters apart (females from Junction, Dinosaur Valley, and Mason area). Mesopleuron opaque, its punctures well defined, up to two diameters apart posteriorly. Upper metapleuron (Fig. 103c, d) with short, oblique lamella that starts beneath anterior end of flange, and one or two horizontal carinae that start behind the lamella and end before propodeal spiracle; flange broad, almost as in *psilocerus*, overhanging metapleural surface posteriorly. Propodeal dorsum rugose, side and hindface ridged. Sternum I without apical depression. Discal micropunctures of tergum II several to many diameters apart. Terga I and II without any sculpture apicomesally (Fig. 103e). Hindcoxa carinate, carina expanded basally.

Setae erect, 1.0 MOD long on vertex; suberect, 1.0 MOD long on scutum (oriented evenly posterad mesally); appressed on midfemoral venter; not obscuring integument between antennal socket and orbit. Setae of propodeal dorsum oriented anterad, except a few inconspicuous basomedian setae that are oriented posterad.

Body black. Wings almost hyaline. Terga I–III or I–IV silvery fasciate apicolaterally.

♀.—Clypeus (Fig. 103a): bevel about as long as basomedian area, but large punctures extending over whole clypeal middle section in a female from Dinosaur Valley (fine, dense punctures absent); lip arcuate or sinuate, not emarginate mesally or incised laterally. Dorsal length of flagellomere I 2.0–2.2× apical width. Vertex width about 1.8× length. Tergum V with ill-defined micropunctures, its apical depression impunctate. Pygidial plate alutaceous, with a few sparse punctures. Length 6.5–7.0 mm.

Frontal vestiture golden.

♂.—Inner mandibular margin with tooth (Fig. 103f). Clypeus (Fig. 103f): lobe arcuate or obtusely triangular, its corners rectangular to widely obtuse, separated by a distance that equals 0.9 of clypeal length and 0.9 of distance from corner to orbit. Dorsal length of flagellomere I 0.9–1.0× apical width. Length of flagellomere III about 0.75 of IV. Vertex width 2.0–2.4× length. Forefemoral notch shiny, glabrous. Forebasitarsus with none to three preapical spines whose length does not exceed basitarsal width (the number of spines may be different on the right and the left tarsus). Length 5.0–5.5 mm.

Frontal vestiture silvery.

Discussion.—The presence of the malar space and the peculiar metapleural structure suggest that *psilocerus* and *scopaeus* do not belong to the *pompiliformis* group and that they ought to be placed in a group of their own. Actually *psilocerus* is related to *papago*, as evidenced by the overall body sculpture (especially of terga I and II) and the color of the female antennae. *Tachysphex papago*, with its unspecialized metapleuron and vestigial malar space, is thus a link between *psilocerus* and other members of the *pompiliformis* group.

Tachysphex papago, *psilocerus*, and *scopaeus* share the presence of a short malar space with the Old World *brevipennis* group. However, the absence of an episternal sulcus in that group, and its presence in *psilocerus*, *papago*, and *scopaeus* indicate that they are not related and that the malar space has been acquired independently.

Geographic Distribution (Fig. 104).—Southeastern Texas.

Collecting Period.—7–28 April, 2–17 May, 8–21 October, 4–11 November.

Material Examined.—Holotype: ♀, Texas, Kleberg Co., Kingsville, 1 April 1973, P. W. Treptow (UCD).

Paratypes (15♀, 22♂): TEXAS: **Brazos:** —, JEG (1♀, UCD). **Burleson:** Sommerville, Sal Nolfo (1♀, UMMZ). **Duval:** 8 mi W Premont, Gery Valle (1♀, TAI). **Hidalgo:** Bentsen Rio Grande Valley State Park, WJP (1♀, CAS). **Kenedy:** 27°09′N, 97°41′W, JEG (1♂, UCD; 1♀, 1♂, WJP). **Kimble:** Junction, WJP (1♀, CAS). **Kleberg:** Baffin Bay 6 mi E Riviera, JEG (1♂, UCD), 20 mi SE Kingsville, WJP (4♀, 1♂, CAS). **Mason:** 10 mi N Mason, Michener, Besmere, Wille, and LaBerge (1♀, UCD). **San Patricio:** 5 mi N Sinton, HFE and O. Flint (2♀, 1♂, MCZ), 10 mi NE Sinton on Aransas River, WJP (1♀, 5♂, CAS). **Somervell:** Dinosaur Valley State Park, WJP (1♀, 11♂, CAS). **Williamson:** Shiloh, JEG (1♂, UCD).

Tachysphex psilocerus Kohl

(Figure 104)

Tachysphex psilocerus Kohl, 1884:374, ♀. Holotype: ♀, Mexico: Chapultepec (Naturhist. Mus. Vienna, Austria, ?lost).—Cameron 1888–1900:64; Ashmead 1899: 250; Bohart and Menke 1976:276, Krombein 1979:1629.

Tachysphex helianthi Rohwer, 1911:570, ♀, ! Holotype: ♀, Colorado: Boulder (USNM). Synonymized by Pulawski *in* Krombein 1979:1629.—G. Bohart 1951: 951, Bohart and Menke 1976:274.

Tachysphex nitelopteroides Williams, 1958:207, ♀, ♂, ! Holotype: ♀, Mexico: Baja California (Sur): La Paz (CAS). Synonymized by Pulawski *in* Krombein 1979: 1629.—Arnaud 1970:32, Bohart and Menke 1976:275.

Diagnosis.—The following characters separate *psilocerus* and *papago* from other members of the *pompiliformis* group: the propodeal dorsum and side are punctate (dorsum laterally and side impunctate in some specimens); the posterad oriented basal setae of propodeal dorsum are conspicuous, extending almost from spiracle to spiracle; and the female flagellum is largely brown or red (also red in *pechumani*). The specialized metapleuron of *psilocerus* is distinctive: the flange is broad, and a longitudinal carina, about as long as the flange, is present just beneath it (metapleuron simple in *papago*). The only other species in the *pompiliformis* group with a specialized although not identical metapleuron is *scopaeus* (see that species for details). Other important characters of *psilocerus* (shared with *papago* and *scopaeus*) are the following: short malar space present (rudimentary in some specimens), mesopleural punctures well defined (minute in some specimens), and terga I and II are microsculptured and ciliate except contrastingly unsculptured and glabrous apicomesally. Unlike these two species, the forewing of *psilocerus* has a weak, transverse fascia.

Description.—Malar space present. Frons opaque, punctate, or punctatorugose. Punctures averaging less than one diameter apart on frons, about one diameter apart (or slightly less) on vertex and mesothorax, but varying on scutum. Upper metapleuron with oblique carina that starts at anterior end of flange and ends before propodeal spiracle. Metapleural flange broad, overhanging metapleural integument posteriorly. Propodeal dorsum opaque, with subcontiguous punctures (impunctate laterally in some females); side punctate (impunctate anteriorly in female, ridged basally in some males) or largely impunctate; hindface punctate (punctatorugose in some males). Tergal micropunctures dense, but more than one diameter apart on disk of tergum II; terga I and II without any sculpture apicomesally. Basal tooth of hindcoxa small or medium size. Hindcoxa not carinate.

Setae appressed on vertex and mesothorax. Vestiture not obscuring sculpture, except partly obscuring from certain angles

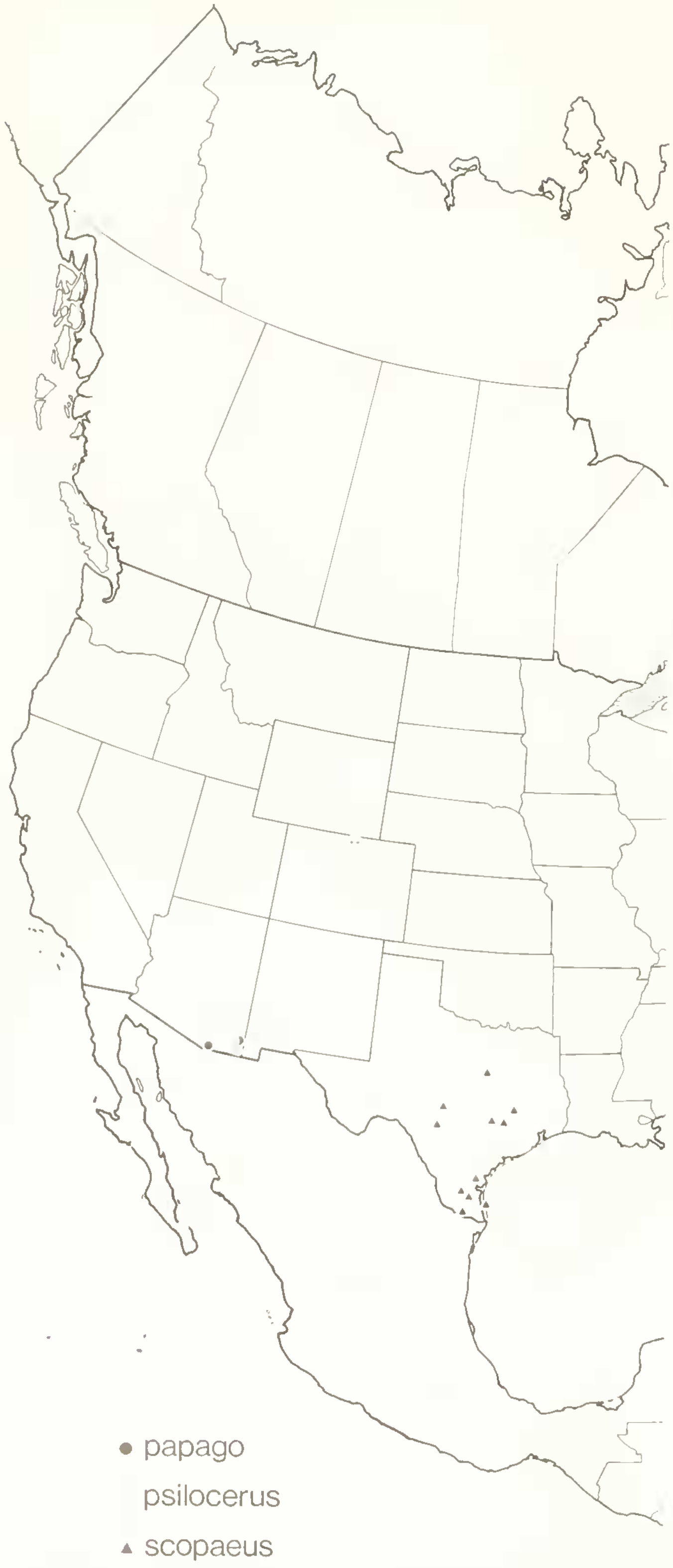

FIGURE 104. Geographic distribution of *Tachysphex papago* Pulawski, *psilocerus* Kohl, and *scopaeus* sp. n.

between antennal socket and orbit. Setae of propodeal dorsum oriented anterad except oriented posterad on broad, basal zone that extends almost from spiracle to spiracle.

♀.—Clypeus: bevel longer to shorter than basomedian area; lip not emarginate mesally nor incised laterally, evenly arcuate or (Portal female) obtusely projected mesally. Dorsal length of flagellomere I 2.7–3.2 × apical width. Vertex width 1.6–1.8 × length. Sternum I shallowly concave apicomesally. Apical depression of tergum V alutaceous, impunctate. Pygidial plate minutely punctate, interspaces alutaceous. Length 5.0–6.5 mm.

Color various (see Variation below). Tergum I not fasciate, terga II and III fasciate apicolaterally. Wings hyaline or nearly so, but forewing with slightly infumate, transverse band mesally. Frontal vestiture golden.

♂.—Mandibular inner margin not dentate. Clypeus: lobe arcuate; lip corners indistinct, as far from eyes as from each other. Dorsal length of flagellomere I 1.4–1.8 × apical width. Vertex width about 1.9 × length. Propodeal side punctate (interspaces microridged, about as broad as punctures) and finely, densely ridged basally, or largely impunctate. Foretarsus without rake; outer apical spine of foretarsomere II about as long as tarsomere width. Forefemoral notch shallow to evanescent (see Variation below). Length 5 mm.

Body black (most specimens) or partly red (Mexico, Wyoming); in the Sonora specimen the following are red: mandible (except apically), clypeus partly, scape, pedicel, flagellomeres I–III, pronotum, scutum partly, scutellum, mesopleuron partly, metapleuron, forecoxa, forefemur partly; tibiae yellowish-red. Wings hyaline.

VARIATION.—*Tachysphex psilocerus* varies considerably in the length of the malar space, sculpture, femoral setae, color, and shape of the male forefemur. Details are given below.

The malar space, at middle, is about 0.7 MOD long in most specimens, but about 0.3 MOD long in the females from Marfa, Texas; Huachuca Mountains, Arizona; and Nombre de Díos, Mexico.

Mesothoracic punctures are usually conspicuous (about as large as in most *psammobius*), but they are minute in Arizona females and a Sonora male.

Scutal punctures are one to two diameters apart in most specimens, but many diameters apart posteriorly in the single female from Arkansas. Most punctures are subcontiguous in Teotihuacán specimens, Huachuca and Portal females, and a Colorado male.

The metapleuron is punctate in most specimens, but is irregularly microrugose in an Apache female.

The metapleural flange is rounded apically or acutely expanded posterad (Arkansas, Colorado, and Durango).

The propodeal side is punctate (alutaceous anteriorly); partly unsculptured in Baja California specimens and an Apache female; or unsculptured (except partly alutaceous) in Texas, Huachuca, and Portal females, and in a Wyoming male.

The propodeal dorsum is impunctate laterally in females from Texas and Huachuca Mts. and Portal in Arizona.

The propodeal hindface is mostly punctate, but punctatorugose in a male from Park Creek, Colorado.

Setae of the midfemoral venter sparse and about 0.5–0.7 MOD long in most individuals but extremely short, dense, appressed in Baja California specimens, Apache and Huachuca females, and a Wyoming male.

The female head is all black (Colorado) or the clypeus and mandible (except apex) are red (Texas, Arizona, Mexico).

The female flagellum is red basally (apex of flagellomere I to base of flagellomere IV: Apache, Arizona, and Arkansas) or more extensively (flagellomeres I–VI: Portal, Arizona, and Texas).

The forefemoral notch is shallow in males from Poudre Canyon, Colorado; Wyoming; and Baja California, but evanescent in males from Teotihuacán and Park Creek, Colorado.

DISCUSSION.—Dr. M. Fischer was not able to find the holotype of *psilocerus* in the Vienna Museum, where it ought to be preserved. However, the species can be recognized by details in Kohl's original description: head and thorax largely red, wings darkened mesally, propodeal hindface punctured, and tergum I not fasciate apically. No other *Tachysphex* has this combination of characters.

GEOGRAPHIC DISTRIBUTION (Fig. 104).—Mexico to Wyoming, east to Arkansas, west to eastern Arizona.

RECORDS AND MATERIAL EXAMINED.—UNITED STATES: ARIZONA: **Cochise:** 1 mi E Apache (1♀, AMNH), Portal (1♀, HKT), Sunnyside Canyon in Huachuca Mts. (1♀, UCD). ARKANSAS: **Newton:** —(1♀, UAF). COLORADO: **Boulder:** Boulder (holotype ♀ of *helianthi*, USNM, 1♀, CNC). **Larimer:** Chimney Rock 60 mi NW Fort Collins (1♀, CAS), Park Creek 20 mi N Fort Collins (1♂, WJP), Poudre Canyon (1♂, CU). TEXAS: **Presidio:** Marfa (1♀, NYSU). WYOMING: **Fremont:** Shoshone (1♂, UCD).

MEXICO: **Baja California Sur:** La Paz (holotype ♀ and paratype ♂ of *nitelopteroides*, CAS). **Distrito Federal:** Chapultepec (Kohl 1884). **Durango:** 7 mi W Durango (1♀, CNC), Nombre de Dios (1♀, CIS). **México:** Teotihuacán pyramids (1♀, 1♂, MCZ). **Sonora:** 10 mi E Navojoa (1♂, UAT).

Tachysphex ashmeadii W. Fox

(Figures 105, 106)

Tachysphex Ashmeadii W. Fox, 1894*a*:509, ♀ (incorrect original spelling). ! Holotype: ♀, California: San Diego (ANSP).—Dalla Torre 1897:678 (as *ashmeadis*); Ashmead 1899:250; Cresson 1928:43, Strickland 1947:129, G. Bohart 1951: 950; Krombein 1967:392; Bohart and Menke 1976:272; Krombein 1979:1631; Rust et al. 1983:406; Elliott and Kurczewski 1985:295; Parks 1986:34; Kurczewski 1987:122

Tachysphex posterus W. Fox, 1894*a*:510, ♀. ! Holotype: ♀, Washington: no specific locality (ANSP). Synonymized by R. Bohart *in* Bohart and Menke 1976:272.—Dalla Torre 1897:684, Ashmead 1899:250; Cresson 1928:45, G. Bohart 1951: 952.

Tachysphex spinosus W. Fox, 1894*a*:511, ♀. ! Holotype: ♀, California: Los Angeles Co.: no specific locality (USNM). Synonymized by G. Bohart 1951:950.—Dalla Torre 1897:685, Ashmead 1899:250; Rust et al. 1983:406.

Tachysphex spissatus W. Fox, 1894*a*:514, ♂. ! Holotype: ♂, California: no specific locality (ANSP). Synonymized by G. Bohart 1951:950.—Dalla Torre 1897:685, Ashmead 1899:250 (as *pissatus*); Cresson 1928:46.

Larra rufipes Provancher, 1895:129, ♀. ! Holotype: ♀, California: Los Angeles (Laval Univ., Quebec). Nec *Larra rufipes* (F. Smith, 1858) Kohl, 1885. Nec *Tachysphex rufipes* (Aichinger, 1870) Kohl, 1885. Synonymized by G. Bohart 1951:950.

Tachysphex propinquus Viereck, 1904:87, ♀. ! Holotype: ♀, Arizona: Pinal Co.: Florence (ANSP). Synonymized by Pulawski *in* Krombein 1979:1632.—Snow 1906:8; Viereck 1906:235; Williams 1914:162, 202, Mickel 1918:425, Cresson 1928:45, G. Bohart 1951:962, Krombein 1961:82, 1967:393, Alcock and Gamboa 1975:164; Bohart and Menke 1976:276.

DIAGNOSIS.—*Tachysphex ashmeadii* can be recognized by its distinctive clypeus (Fig. 105a–c, f), the labrum convex and protruding in nearly all specimens (Fig. 105b, c), and the radially oriented midscutal setae that form a rosettelike pattern (Fig. 105d, e). In the other North American species the labrum is flat, usually concealed, and the scutal setae do not form a rosette (except in most *opata*, some *crassiformis*, some *pinal*, and some *yolo*). Other features of *ashmeadii* are: the basal platform of sternum II is angulate, the free margin of the male clypeus is shallowly concave between the lobe and orbit, and male sterna III–VI have well-defined graduli that delimit a triangular, basomedian area (*opata* lacks these three features). *Tachysphex ashmeadii* lacks a flat, horizontal depression at the apex of sternum I found in *yolo*. The clypeal lobe of *crassiformis* and *pinal* is markedly broader than in *ashmeadii*, and most *crassiformis* have an expanded or steplike axilla (see that species).

DESCRIPTION.—Galea and labrum variable (see Variation below). Clypeal free margin shallowly concave between lobe and orbit; middle section convex; bevel usually longer than basomedian area, but occasionally as long as the latter. Propodeal dorsum microareolate. Hindcoxa not carinate.

Middle scutal setae arranged in an oval, rosettelike pattern (Fig. 105d, e); setae oriented anterolaterad before center (anterad on middle), and posterad behind center.

Gastral terga I–IV silvery fasciate apically. Wings hyaline.

♀.—Clypeus (Fig. 105a–c): lip usually biarcuate, but occasionally evenly arcuate, not incised laterally. Dorsal length of flagellomere I 1.9–2.4× apical width. Vertex width 0.8–1.2× length. Punctures: on frons below midocellus mostly subcontiguous (but a few punctures usually about one diameter apart); on vertex less than one to about two diameters apart, usually fine, but sometimes relatively large; on scutum usually less than one diameter apart (mostly subcontiguous), but sometimes many discal punctures several diameters apart; on mesothoracic venter fine, less than one diameter apart; on trochanters and femora fine, subcontiguous. Mesopleuron microreticulate or finely punctate (punctures less than one diameter apart). Propodeal site microareolate, rarely microridged, occasionally punctate. Tergum V with dense or sparse punctures, its apical depression impunctate. Sterna III and IV with variously developed graduli. Pygidial plate punctate, interspaces smooth or alutaceous. Length 8.5–11.0 mm.

Setae appressed on vertex, except suberect or erect (0.75–1.0 MOD long) on postocellar depression, appressed on scutum and femora, partly obscuring mesopleural sculpture.

Color varying, but usually head, thorax, coxae, trochanters, and forefemur black, while remaining legs and gaster red. Lightest specimens have red scapus, middle clypeal section, part of flagellum, thorax, gaster, and legs. Melanistic individuals have black head, thorax, legs, and gastral segments V and VI or terga III and IV. All femora and tibiae black except femur partly red in a female from Temixco, Mexico (UCD).

♂.—Mandibular inner margin with obtuse tooth (Fig. 105f). Clypeus (Fig. 105f): lip evenly arcuate, its corners obtuse, closer to orbit than to each other. Dorsal length of flagellomere I 1.0–1.3× apical width, usually much less than flagellomere II. Vertex width 1.2–1.4× length. Punctures on frons below midocellus subcontiguous to about one diameter apart; on vertex fine to relatively large, less than one diameter apart; on scutum well defined, mostly (except small specimens) more than one diameter apart on each side of midline; on mesopleuron variable (see below). Propodeal side microareolate, microridged, or punctate (interspaces microsculptured). Tergum VII flattened, densely punctate. Sterna densely punctate and pubescent, sterna III–VI with graduli. Forefemoral notch variable. Outer margin of forebasitarsus usually without preapical spines, occasionally with one or two preapical spines; apical spine longer or shorter than basitarsal width. Length 5.5–8.5 mm.

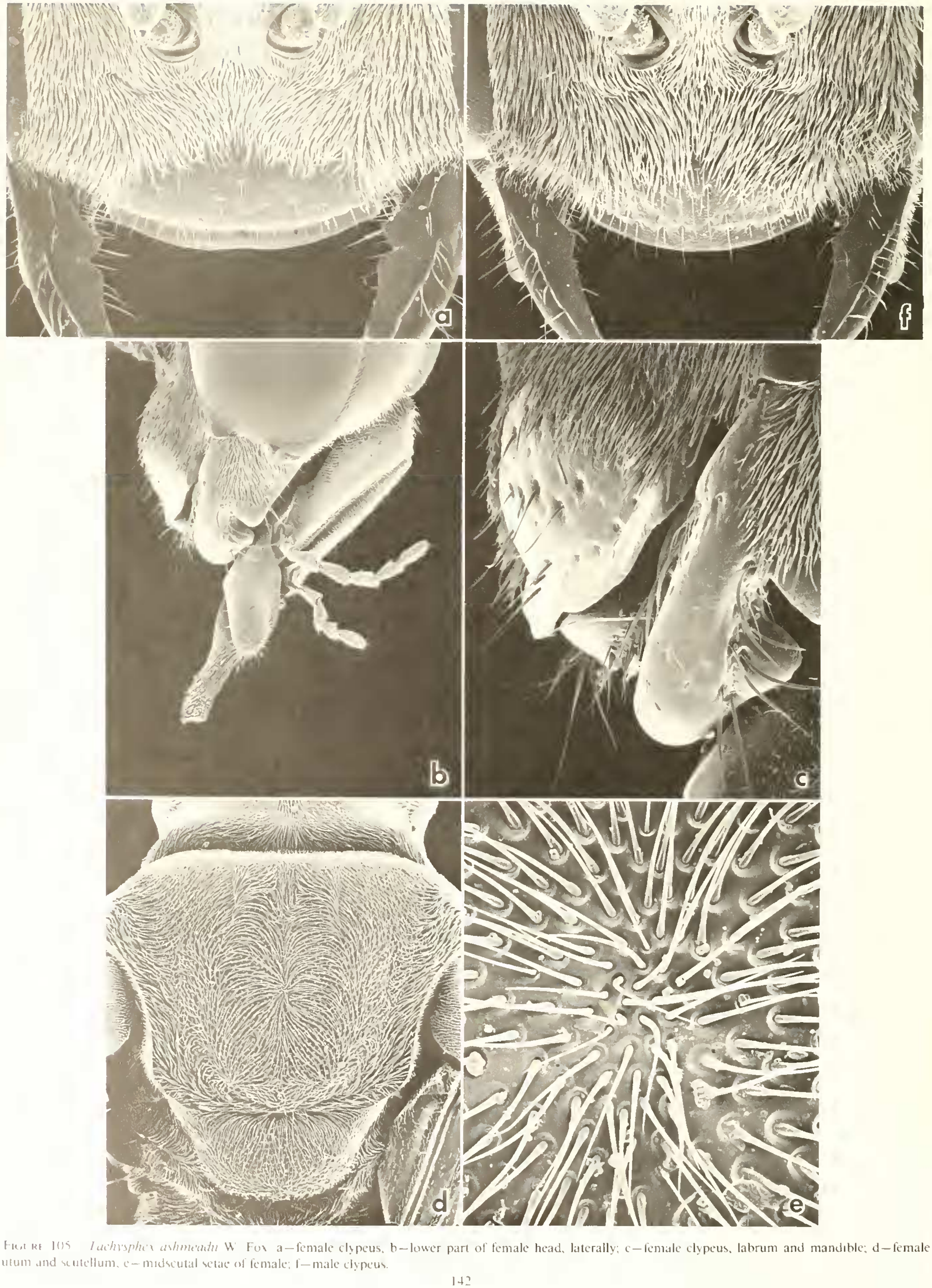

FIGURE 105. *Tachysphex ashmeadi* W. Fox. a—female clypeus, b—lower part of female head, laterally; c—female clypeus, labrum and mandible; d—female scutum and scutellum, e—midscutal setae of female; f—male clypeus.

Setae appressed to erect, 0.75–1.0 MOD long on vertex, 1.0–1.25 MOD long on scutum; appressed on midfemoral venter.

Head and thorax black. Gastral segments I and II to I–IV red, remainder black; rarely all sterna black, and gaster all black in a male from Pyramid Lake, Nevada (UCD). Legs black. Frontal vestiture silvery.

VARIATION.—In most specimens, the labrum is convex, protruding beyond the clypeal free margin, and the galea is about as long as wide (Fig. 105b, c). However, these structures are relatively short in some Californian specimens, and occasionally the labrum is nearly flat and does not exceed the clypeal margin, and the galea is shorter than wide.

The frontal and thoracic vestiture is silvery in most specimens, but has a golden tinge in some Mexican females (Guerrero: Zumpango; Morales: Temixco; Puebla: Petlalcingo; Sinaloa: Elota, Mazatlán; 6♀, UCD).

Sculpture and vestiture vary in males and the extreme forms are characterized as follows:

1) Mesopleural punctures fine, subcontiguous; propodeal side dull, with abundant microsculpture, punctures evanescent; setae appressed on vertex and scutum, about 0.75 MOD long on vertex; erect microsetae of antennal flagellum very short.

2) Mesopleural punctures large ventrally, one to three diameters apart; propodeal side shiny, with well-defined punctures. Microsculpture evanescent; setae erect on vertex and scutum, about 1.0 MOD long on vertex; erect microsetae of antennal flagellum relatively long.

These two extremes, as well as intermediate forms, have been found at Hasty, Colorado; La Joya, New Mexico; Nixon, Nevada; and in many other localities.

DISCUSSION.—The relationship of *ashmeadii* to other species in the genus is somewhat unclear. Generally *ashmeadii* resembles the Old World *panzeri* group and the Neotropical *undatus* group in having a convex, protruding labrum (labrum flat in some small *ashmeadii*), and a slightly elongate galea. However, the shape of the galea, the presence of well-defined graduli on male sterna III–VI, and the geographic distribution (western North America), suggest that *ashmeadii* is unrelated to these groups. Characters of the *panzeri* group are: the galea is longer than wide (in *ashmeadii*, about as long as wide or wider), length of male vertex 0.5–1.1 × width (1.2–1.4 in *ashmeadii*), and male sterna lack graduli. In the *undatus* group, the galea is longer than wide, the propodeal sculpture is coarser than in *ashmeadii*, especially on the dorsum, and male sterna also lack graduli. The vertex setae are appressed or nearly so in the *panzeri* group, erect in the *undatus* group, and either appressed or erect in *ashmeadii*. Most probably *ashmeadii* is an aberrant member of the *pompiliformis* group, close to such species as *amplus*, *lamellatus*, *sonorensis*, *texanus*, and *yolo*. These species resemble *ashmeadii* in details of sculpture and vestiture, and their labrum may be slightly prominent (although it is generally flat).

LIFE HISTORY.—Males and females from the Apache and Portal area, Arizona, were collected on flowers of *Baccharis glutinosa* Pers., and specimens from Antioch, California, were collected on flowers of *Croton californicus* Muell.-Arg. and *Eriogonum nudum* (Dougl. ex Benth.). A female from Logan, Utah (USU), was captured on flowers of *Daucus carota* L. Nesting takes place in sandy soils. Nest digging may start either from the surface or from preexisting depressions such as animal tracks (Elliott and Kurczewski 1985). Digging females enter the burrow headfirst and throw sand backward with forelegs (which work in unison) while backing out from the burrow. The nest is unicellular and permanently open during the provisioning period. The tumulus that accumulates during digging is left intact. The nest's length and depth vary: the nests observed by Williams (1914) were 5.0–7.5 cm long and ended 2.5–5.0 cm below the surface, those observed by Elliott and Kurczewski (1985) were 8.9–10.4 cm and 5.0–5.9 cm, respectively, while Kurczewski (1987) reported 3.5 and 1.5 cm. Completion of the nest is followed by an orientation flight. Recorded prey are nymphs and adults of Acrididae as listed below:

Species	Source
Ageneotettix deorum (Scudder)	Williams 1914, Lavigne and Pfadt 1966
Arphia sp.	Elliott and Kurczewski 1985
Bruneria sordida (McNeill)	Elliott and Kurczewski 1985
Cordillacris crenulata (Bruner)	Williams 1914 Krombein 1979
Cordillacris occipitalis (Thomas)	Lavigne and Pfadt 1966
Melanoplus bivittatus (Say)?	Elliott and Kurczewski 1985
Melanoplus lakinus Scudder	Elliott and Kurczewski 1985
Melanoplus sanguineus (Fabricius)	Elliott and Kurczewski 1985
Melanoplus sp.	Elliott and Kurczewski 1985; Kurczewski 1987
Metator sp.	Krombein 1967
Opeia sp.	Krombein 1967
Orphulella sp	Elliott and Kurczewski 1985
Phlibostroma sp.	Krombein 1967
Trachyrhachys kiowa (Thomas)	Williams 1914, Lavigne and Pfadt 1966
Trimerotropis bilobata Rehn and Hebard	Elliott and Kurczewski 1985
Trimerotropis pallidipennis (Burmeister)	Elliott and Kurczewski 1985
Trimerotropis sp.	Elliott and Kurczewski 1985

In addition, I have seen females pinned with prey not previously reported (prey identification by D. C. F. Rentz when not indicated otherwise). They are listed below:

Species	Locality and depository
Aulocara sp	Oklahoma: Lake Texoma (UCD)
Dissosteira pictipennis Bruner	California: Arroyo Seco (UCD)
Cordillacris occipitalis (Thomas)	California: Cajon (UCD)
Orphulella pelidna (Burmeister)	Texas. Padre Island (CAS, det. D. Otte)
Schistocerca sp.	Oklahoma: Lake Texoma (UCD)
Trimerotropis sp.	Arizona: 3 mi E Portal (CAS)

The prey are often much larger than the wasp, and prey's head is sometimes masticated by the wasp to obtain liquids (Williams 1914). Prey are transported (Williams 1914; Kurczewski 1987) on the ground and/or in short flights, but small prey are carried exclusively in flight (Williams 1914). His description suggests that the prey were kept venter up. They are held by the bases of their antennae with the wasp's mandibles. Prey are taken into the nest without stopping at the entrance and deposited in the cell head inward and in most cases venter up; Alcock and Gamboa (1975) and Kurczewski (1987) found one prey positioned on its side. Most cells contain a single prey, but Elliott and Kurczewski (1985) found two cells, each with two prey, in Saint Anthony, Idaho. In the single case examined, the egg was laid on the grasshopper brought last into the nest. Kurczewski (1987) reported that the egg was laid on the left forecoxal corium and extended transversely between the fore- and midcoxae.

GEOGRAPHIC DISTRIBUTION (Fig. 106).—Xeric areas west of the 95th meridian, north to southern Canada, south to Costa Rica; also Florida panhandle.

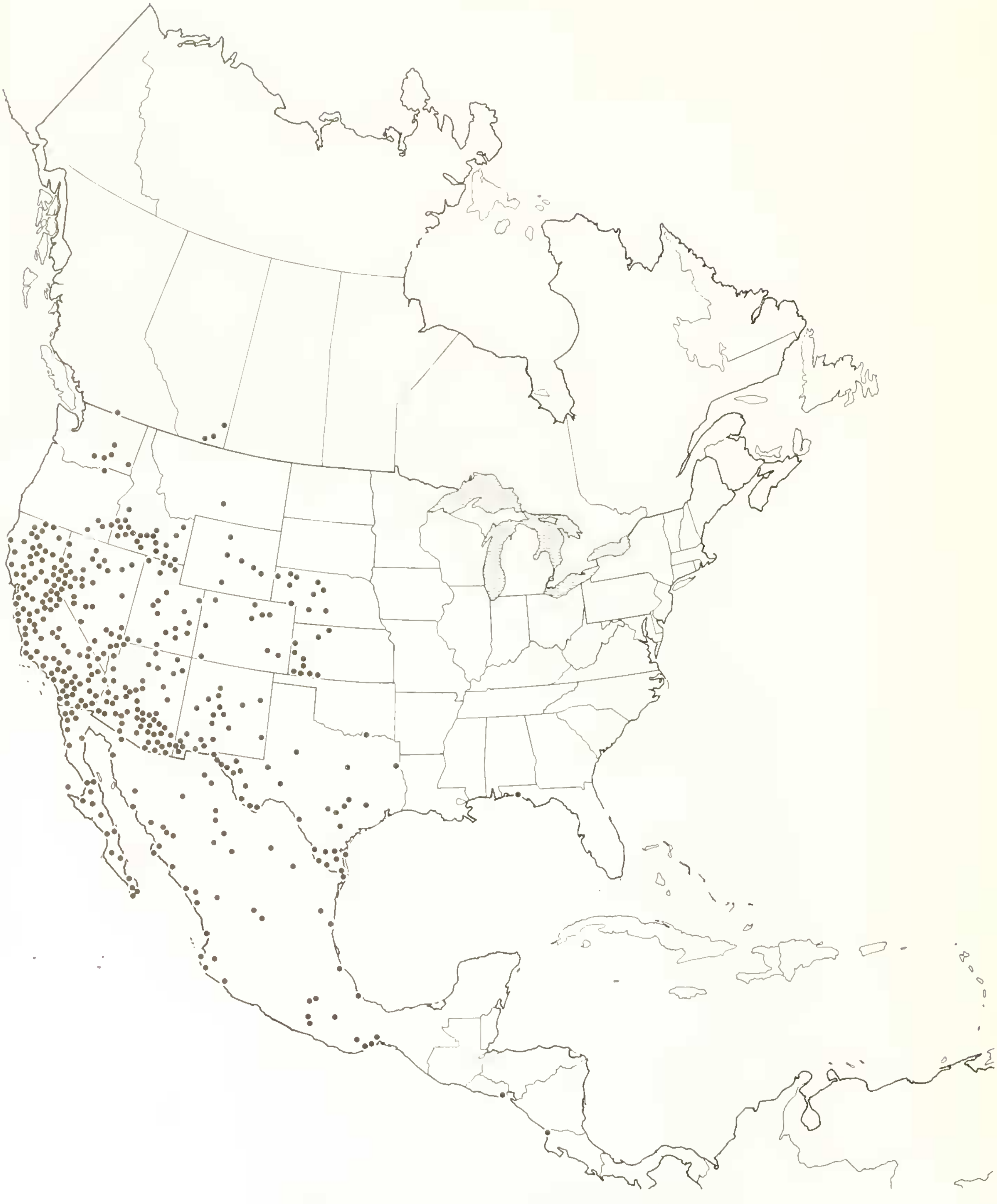

FIGURE 106. Geographic distribution of *Tachysphex ashmeadii* W. Fox.

MATERIAL EXAMINED.—2,022♀, 1,775♂.

RECORDS.—CANADA: **Alberta:** Medicine Hat, 12 km SW Orion, Writing-on-Stone Provincial Park. **British Columbia:** Osoyoos.

UNITED STATES: ARIZONA: **Apache:** Canyon de Chelly, Chinle. **Cochise. Coconino. Gila:** 3 mi SW Christmas, San Carlos, 5 mi N Seneca. **Graham. Maricopa. Mohave. Navajo. Pima. Pinal. Santa Cruz. Yavapai. Yuma.** CALIFORNIA: **Alameda:** Livermore (also 15 mi E, 17 and 20 mi S), Sycamore Grove State Park. **Butte:** Chico. **Colusa:** Ladoga. **Contra Costa:** Antioch. **El Dorado:** Chili Bar, 10 mi NE on Ice House road. **Fresno. Glenn:** Artois. **Humboldt:** Honeydew. **Imperial. Inyo. Kern. Lassen:** Hallelujah Junction, 2.9 mi E Susanville. **Los Angeles. Mariposa:** 2 mi S Mormon Bar. **Mendocino:** Navarro River at Highway 128 (Hendy Grove State Park), Twin Rocks (5 air mi E Cummings). **Modoc:** Alturas (also 3 mi W and 10 mi N). **Mono. Monterey. Nevada:** Boca, Nevada City, Sagehen Creek near Hobart Mills. **Orange:** Corona del Mar, Costa Mesa, Santa Ana. **Placer:** Auburn. **Plumas. Riverside. Sacramento. San Benito. San Bernardino. San Diego. San Joaquin:** Corral Hollow (8 mi SW Tracy). **San Luis Obispo. Santa Barbara. Santa Clara:** San Antonio Ranger Station. **Santa Cruz:** Mt. Hermon, Watsonville. **Shasta:** Hat Creek Post Office, Redding. **Siskiyou. Solano:** Rio Vista. **Sonoma:** Geyserville. **Stanislaus:** Del Puerto Canyon, Patterson (also 5 mi W). **Tehama:** Manton, Red Bluff. **Trinity:** Junction City. **Tulare:** Lemon Cove, Three Rivers. **Tuolumne:** Brown Meadow, Groveland, Strawberry. **Ventura. Yolo:** Davis, Rumsey. COLORADO: **Bent:** 2 mi S Hasty. **Boulder:** White Rock near Boulder. **Crowley:** Crowley. **Larimer:** Fort Collins. **Mesa:** Colorado National Monument. **Moffat:** Sunbeam. **Montezuma:** Mancos River (28 mi S Cortez). **Morgan:** 6 mi E Wiggins. **Prowers:** Carlton, 13 mi S Lamar. **Sedgwick:** Julesburg. **Weld:** Roggen. FLORIDA: **Okaloosa:** Destin (1♂, FSCA). IDAHO: **Ada:** Boise. **Bingham:** 6 mi NW Aberdeen. **Blaine:** Carey. **Boise:** 1 mi W Horseshoe Bend. **Bonneville:** 5 mi W Idaho Falls. **Canyon:** Marsing, 2 mi N Melba, Nampa, Parma. **Cassia:** 5 mi SE Malta (also 9 mi E), Yale. **Elmore:** 1 mi W Glenns, Hammett, 13 mi S Sunnyside. **Franklin:** Preston (also 3 mi NW). **Fremont:** Saint Anthony Sand Dunes. **Gooding:** 5 mi N Bliss, 1 mi NE Gooding (also 3 mi S), Hagerman Valley. **Lincoln:** 5 mi E Dietrich, 7 and 9 mi W Shoshone. **Minidoka:** Acequia. **Oneida:** 5 mi S Holbrook, Rock Creek. **Owyhee. Twin Falls.** KANSAS: **Clark, Graham, Grant, Greeley, Morton, Phillips, Seward, Stevens:** —. **Kearny:** Lakin, McKinney Lake. **Wallace:** Sharon Springs. MONTANA: **Stillwater:** —. NEBRASKA: **Box Butte:** Alliance. **Cherry:** Valentine Lakes Refuge. **Dawes:** Chadron. **Dawson:** Cozad. **Lincoln:** Wallace. **Sheridan:** Rushville. **Sioux:** Harrison. **Thomas:** Dismal River in Bessy National Forest, Halsey, Thedford. NEVADA: **Carson City:** Carson City. **Churchill:** Eastgate (also 6 mi SE), Fallon (also 5 mi NE and 23 mi E), 3 mi W Hazen. **Clark. Douglas:** 3 mi S Genoa, 3 mi N Minden, Topaz Lake. **Elko:** 6 mi S Deeth. **Esmeralda:** 15 mi S Goldfield. **Eureka:** Beowawe Pass, Emigrant Pass, Eureka. **Humboldt. Lander:** 5 mi W Austin. **Lincoln. Lyon. Mineral. Nye. Pershing:** Woolsey. **Storey:** Geiger Gd. **Washoe. White Pine:** Spring Valley. NEW MEXICO: **Bernalillo:** Albuquerque. **Catron:** Pie Town. **Cibola:** Acoma Pueblo, 5 mi E Laguna. **Dona Ana:** Hatch, Las Cruces (also 12 mi SW, 19 mi W), Leasburg Dam State Park. **Grant:** Hurley, 14 mi NW Silver City. **Guadalupe:** Santa Rosa. **Hidalgo. Lea:** 2 mi NW Tatum. **Lincoln:** Nogal. **Luna:** Columbus, 6 mi NW Florida. **Otero:** 35 mi NE Las Cruces, White Sands National Monument. **Quay:** Tucumcari, Ute Lake. **Sandoval:** Jemez Springs. **Sierra:** Percha Dam State Park. **Socorro. Torrance:** Gran Quivira (town). OKLAHOMA: **Marshall:** Lake Texoma (2 mi E Willis). OREGON: **Grant:** Dixie. **Harney:** Roux Creek (3 mi S 2 mi W Fields). **Malheur:** 6 mi E Burns Junction, Jordan Valley (also 50 mi W). **Umatilla:** Hat Rock State Park. TEXAS: **Bastrop:** 6 mi E Bastrop, McDade. **Bexar:** —. **Brazos:** College Station, Wellborn. **Brewster. Brooks:** Encino (also 8 mi E), Falfurrias. **Cameron:** 14 mi E Brownsville. **Crockett:** Fort Lancaster Historical State Park. **Culberson:** Plateau, Van Horn. **El Paso:** El Paso (also 15 mi E). **Guadalupe:** Seguin. **Harrison:** 2 mi S Waskom. **Hidalgo:** McAllen Botanical Garden. **Hudspeth. Jeff Davis:** 10 mi W Fort Davis. **Jim Hogg:** 3 mi SW Hebbronville. **Jim Wells:** Palito Blanco. **Karnes:** Guillette. **Kleberg:** Kingsville (also 20 mi SE), Riviera. **Lee:** Fedor, Giddings. **Maverick:** Quemado. **Mitchell:** Lake Colorado City State Park. **Nueces:** Padre Island. **Presidio:** Marfa (also 8 mi E), 2 mi E Presidio. **Somervell:** Dinosaur Valley State Park. **Tarrant:** Colleyville. **Ward:** 1 mi S Grandfalls, 8 mi E Monahans. **Webb:** 15 mi SE Laredo (also 32 air mi N). **Zapata:** Falcon State Park, San Ygnacio. UTAH: **Box Elder. Cache:** Cornish, Logan. **Emery. Garfield. Grand:** Canyonland National Park, Salt Valley (NW Arches National Park). **Juab:** White Sand Dunes (25 mi SW Eureka). **Kane:** 23 mi N Page (in Arizona). **Millard. Uintah:** SW Bonanza. **Utah:** Utah Lake. **Washington. Wayne:** Hanksville. WASHINGTON: **Benton:** Riverland. **Franklin:** 28 mi S Othello. **Grant:** O'Sullivan Dam, Stratford. **Whitman:** Wawawai. **Yakima:** 5.5 mi S Toppenish, Yakima City. WYOMING: **Converse:** Glenrock. **Fremont:** Shoshoni. **Natrona:** Powder River. **Platte:** Glendo. **Sweetwater:** Wamsutter. **Washakie:** Worland.

MEXICO: **Baja California Norte. Baja California Sur. Chihuahua:** 10 and 20 mi N and 15 mi S Chihuahua, 4 mi N Ciudad Camargo, 5 mi N Escalon, Hidalgo del Parral (also 9 mi S), 60 mi S Juárez, Moctezuma, 10 km S Villa Ahumada. **Coahuila:** 10 km SW Cuatrociénegas, 61 mi N Saltillo. **Colima:** Manzanillo. **Durango:** 4 mi N Nombre de Dios. **Guerrero:** Xalitla, Zumpango. **Jalisco:** Chamela, El Tuito, Plan de Barrancas, Playa Cuitzmala 8 km S Careyes. **Morelos:** 3 mi N Alpuyeca, 6 mi S Temixco, 7.3 mi S Yautepec. **Nayarit:** San Blas. **Oaxaca:** 3 mi W Camarón, 12 mi S Chivela, 23 mi S Mathias Romero, 3 mi E Salina Cruz, Tehuantepec. **Puebla:** Petlalcingo. **Sinaloa:** 6 mi NW Choix, Elota (also SE), 28 km N Los Mochis, Mazatlán, San Lorenzo, 21 mi E Villa Unión. **Sonora:** Alamos (also 10 mi SE), Cócorit, Desemboque, Guaymas, Hermosillo, 10 mi E Navojoa, San Carlos (also 6 km NNW), 32 mi SW Sonoita. **Tamaulipas:** Jaumave (road 101 W Ciudad Victoria), Matamoros (also 30 mi SE), Playa Altamira. **Veracruz:** Tecolutla (also 16 mi S), Veracruz. **Zacatecas:** 9 mi S Fresnillo, 9 mi N Ojocaliente.

CENTRAL AMERICA: COSTA RICA: Junquillal Beach. EL SALVADOR: Playa Icacaya (30 km SW Unión).

terminatus Species Group

Members of the *terminatus* group are defined by the presence of a callosity behind each hindocellus (Fig. 114a); in addition, the labrum is flat, the tarsomeres are not modified, and the setae of the propodeal dorsum are oriented toward the thorax. The callosities are also found in two species belonging to other groups, *iridipennis* (*brullii* group) and the South American *apoctenus* Pulawski (*undatus* group). However, propodeal setae are inclined toward the gaster and the female tarsi are modified in *iridipennis*, and the labrum is convex in *apoctenus*. The common color pattern in the group is a black body with a red gastral tip. In other New World *Tachysphex*, this pattern is found only in *alayoi*, *toltec*, and in some *cubanus*.

Prey consists mainly of Acrididae, but *terminatus* rarely uses Tettigoniidae.

The group is widespread in the New World, ranging from about 63°N in Alaska to about 40°S in Argentina. Of the 11 known species, six are found in North America, *ruficaudis* ranges between southern United States and Argentina, *antillarum* and *quisqueyus* occur in the West Indies, *galapagensis* Rohwer in the Galapagos Islands, and *peruanus* Pulawski on the Peruvian coast (Pulawski 1986).

Characters shared by all species of the *terminatus* group are: clypeal bevel shorter than basomedian area, evanescent in some specimens; vertex width more than length or slightly less; scutal hindcorners rounded (*clarconis*, *galapagensis*) or weakly prominent; mesothoracic venter densely punctate; propodeal side ridged (except unridged in most *galapagensis* and some small males of other species); male sterna III–VI with graduli; vestiture not obscuring sculpture on gena, thorax, and femora; vertex setae erect; scutal setae erect or inclined backwards but not appressed, at least 0.5 MOD long; setae of midfemoral venter 0.3–1.0 MOD long; head, thorax, and legs black.

Unlike the other groups treated here, cladistic analyses were performed on members of the *terminatus* group because: (1) its monophyly is convincingly demonstrated by the presence of a unique synapomorphy, the postocellar swellings (I regard the swellings in *apoctenus* and *iridipennis* as a convergence), and (2) it was possible to take all 11 known members into consideration (by including two extralimital species, *galapagensis* and *peruanus*). Sixteen morphological and biological characters were used in the analyses. Transformation series and character polarities were established by outgroup comparison. Other *Tachysphex* were selected as the principal outgroup, but other Tachytina were also considered. Character states and transformation series are as follows (the letter a indicates the plesiotypic condition, the letters b–g various apotypic conditions):

1) *Frons sculpture.* The frons is variously sculptured in Larrinae, and I regard as primitive a uniformly microsculptured, dull integument with dense, inconspicuous punctures. Within the *terminatus* group, I consider the densely punctate frons with microsculptured interspaces (a) as plesiotypic, and as apotypic the microrugose frons (b) of *similis*, the punctatorugose or rugose frons (c) of *ruficaudis*, and the shiny frons (d) of *apicalis*, with b, c, and d deriving independently from a.

2) *Clypeal width to length ratio.* I regard as plesiotypic, in the *terminatus* group, a medium wide clypeus (a), with the width to length ratio 2.8–3.2 in the female and 3.1–3.3 in the male (or nearly so). I regard as apotypic both a narrow (b) and a broad clypeus (c). The clypeus is narrow if the ratio is 2.0–2.8 in the female and 2.1–2.7 in the male, and broad if the ratio is 3.0–3.4 in the female and 3.2–3.6 in the male.

3) *Clypeal lip of female.* The clypeal lip of the female is plesiotypic if evenly arcuate (a), and apotypic if broadened or produced mesally (b).

4) *Clypeal lip of male.* The clypeal lip is straight, arcuate, or sinuate (a) in most species, but triangular (b) in *peruanus*.

5) *Inner mandibular margin of male.* In most species, the male mandible has a tooth on the inner margin (a), but it is toothless (b) in *peruanus*.

6) *Width of female vertex.* The vertex is narrow (a) in *galapagensis*, *peruanus*, and *similis* (width 1.3–1.7 × length), and broad (b) in the remaining species (width 1.7–2.6 × length).

7) *Mesopleural punctures.* The mesopleuron is variously sculptured in Larrinae; an impunctate, uniformly microsculptured mesopleuron is probably plesiotypic. I accept that, in the *terminatus* group, the shallow, ill-defined but uniformly dense punctures (a) found in the female of *galapagensis* are plesiotypic, that the well-defined punctures (b) of other species derived from a, and that the well-defined, sparse punctures (c) of *ruficaudis* derived from b.

8) *Metapleural flange.* The metapleural flange is narrow, inconspicuous (a) in most Larrinae, but expanded (b) in some, including most species of the *terminatus* group.

9) *Oblique carina beneath anterior end of metapleural flange.* This carina is absent (a) in most Larrinae, but rudimentary (b) in *antillarum* and well developed (c) in most other members of the *terminatus* group. It attains the external margin of the flange (d) in most *linsleyi*. I assume a linear transformation series.

10) *Prespiracular prominence of upper metapleuron.* The upper metapleuron is simple (a) in the vast majority of Larrinae. It has a short carina before the propodeal spiracle (b) in *antillarum*, and a long carina, extending to the anterior end of the flange (c) in *ruficaudis* (the long carina has probably evolved from b). A low prominence, obtusely angulate in side view (d), found in *alpestris*, has probably also derived from b. The funnel-shaped prominence unique to *linsleyi* (e), and a tall, broad prominence (f) found in *apicalis*, *quisqueyus*, and *terminatus* have probably developed from d. A tall, sharp prominence (g) found in most *similis* has probably derived from f.

11) *Sculpture of propodeal side.* This area is variously sculptured in Larrinae, but a uniformly microsculptured integument is probably plesiotypic. I accept that the nonridged (or weakly ridged) propodeal side of *galapagensis* is plesiotypic (a), and that a distinctly ridged propodeal side of other species derived from a.

12) *Basal tooth of hindcoxa.* The tooth is absent in many *Tachysphex* and other larrine genera, and low (a) or high (b) in members of the *terminatus* group.

13) *Male forefemoral notch.* In most Larrinae the forefemur is entire. Within *Tachysphex* a notched forefemur (a) is plesiotypic, because it occurs in most species of the genus, including the least specialized ones. The entire forefemur (b) of some *Tachysphex* is a reversal, because it occurs in evidently unrelated species, none of which is morphologically primitive.

14) *Male foretarsal rake.* I regard the rake's absence (a) as plesiotypic in the genus and its presence (b) as apotypic.

15) *Vertex setae.* I regard short setae as plesiotypic, because this type occurs in the least specialized members of the genus (such as *pompiliformis*). Within the *terminatus* group, the vertex setae are either short (a): less than 2.0 MOD in the female; or long (b): 2.0 MOD or more in the female.

16) *Nest placement.* Most Larrini nest in both flat or inclined ground (a), but *apicalis* establishes its nests exclusively in sloping banks or cliffs (b). The nesting habits have not been observed in *antillarum*, *galapagensis*, *peruanus*, and *quisqueyus*, and I accept for the purpose of this analysis that they nidify in flat ground.

The above list includes 27 character states. Four characters (1, 4, 5, and 16) are autapomorphies and thus have no value in establishing relationships between species.

Two microcomputer packages were used to infer phylogenetic relationships: CLINCH Version 6.2 (Kent Fiala's compatibility program) and PAUP Version 2.4 (David Swofford's parsimony package).

The CLINCH algorithm found that 11 was the maximum number of compatible characters. There were two groups (cliques) of such characters. The first consisted of characters 7, 8, 9, 11, 12, 13, and 15 (plus the autapomorphies), the second of characters 2, 7, 8, 9, 10, 11, and 12. I preferred the second clique because it contained character 10 (metapleural carinae and prominences), unusual in *Tachysphex*, rather than character 15 (length of vertex setae), which is plastic within the genus. A secondary compatibility analysis was performed on the portion of the cladogram not resolved in the primary analysis. Incompatible characters were then manually added to the cladogram, and its length was minimized by accepting reversals of character 6 in *similis*, and of character 15 in *apicalis* and *ruficaudis*. The cladogram length was 36 steps (transformations).

The PAUP branch and bound algorithm found that 36 steps was the minimum cladogram length. It generated 117 cladograms of that length, although many were topologically identical (an unresolved trichotomy is treated by the algorithm as three sets of two successive dichotomies with one zero-length branch). One of the cladograms, common to both the compatibility and parsimony analyses, was accepted (Fig. 107).

All cladograms were in consensus that: (1) *galapagensis* is the most primitive member of the group, identical to the group's ancestor (this conclusion is correct only if the polarity accepted for characters 7 and 11 is correct); (2) *peruanus* is a sister species of all remaining species, and not an ancestor of *galapagensis*, as the geographic distribution of these species may suggest (*peruanus* apparently evolved from the group's ancestor, whereas

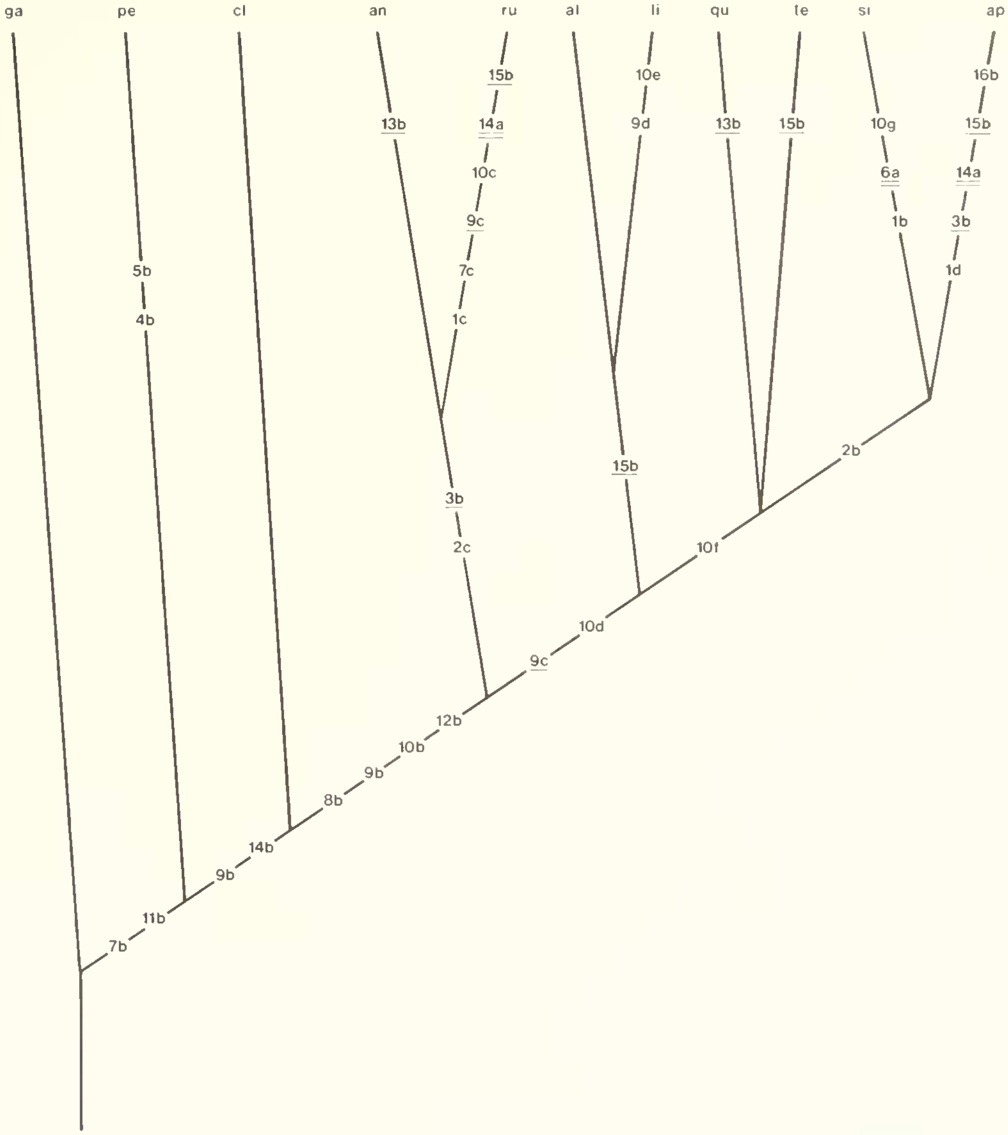

FIGURE 107. Hypothetical phylogenetic tree of all known members of the *terminatus* group. Numbers and letters refer to the characters listed in the text (plesiomorphic states are omitted); underlining indicates parallelisms, and double underlining indicates reversals, al—*alpestris*, an—*antillarum*, ap—*apicalis*, cl—*clarconis*, ga—*galapagensis*, li—*linsleyi*, pe—*peruanus*, qu—*quisqueyus*, ru—*ruficaudis*, si—*similis*, te—*terminatus*

galapagensis retained its plesiotypic characters); (3) *clarconis* is the sister group of all other members of the group excluding *galapagensis* and *peruanus*; and (4) the monophyly of the remaining eight species is strongly supported by four synapomorphies (8b, 9b, 10b, 12b).

All cladograms also suggested multiple parallelisms and reversals during the group's evolution. The cladogram in Figure 107 suggests that: (1) character 3b (clypeal lip of the female with a median projection) developed in the common ancestor of *antillarum* and *ruficaudis*, and also in *apicalis*; (2) character 9c (oblique metapleural carina) evolved in *ruficaudis* and also in the common ancestor of six terminal species; (3) character 12b (entire male forefemur) appeared independently in *antillarum* and *quisqueyus*; and (4) character 14b (long vertex setae) was acquired by the common ancestor of *alpestris* and *linsleyi*, and also by *terminatus*. The cladogram also suggests the following reversals: (1) a secondary narrowing of the vertex (character 6) in *similis*; and (2) a secondary loss of the foretarsal rake (character 14) in the males of *apicalis* and *ruficaudis*.

Tachysphex clarconis Viereck

(Figure 108)

Tachysphex clarconis Viereck, 1906:211, ♂, ♀. Holotype: ♀, Kansas: Clark Co.: no specific locality (KU).—Williams 1914:173; G. Bohart 1951:950; LaBerge 1956:527; Bohart and Menke 1976:273; Krombein 1979:1631; Elliott and Kurczewski 1985:294; Rust et al. 1985:46, 53.

Tachysphex plesia Rohwer, 1917*b*:245, ♀ (wrong gender ending, *plesius* is correct). Holotype: ♀, California: El Dorado Co.: Tahoe (USNM). Synonymized by Pulawski *in* Krombein 1979:1631.—G. Bohart 1951:952; Bohart and Menke 1976:275.

Tachysphex sp. near *linsleyi*: Evans 1970:490, corrected to *Tachysphex clarconis* by Kurczewski and Evans 1986:720.

Diagnosis.—*Tachysphex clarconis* differs from other North American members of the *terminatus* group in having an unspecialized metapleuron: its upper portion is ridged but has neither a prominence before the propodeal spiracle nor an oblique carina beneath the anterior end of the flange (there may be a rudimentary ridge there); and the flange is narrow. Unlike most species of the group, the gaster is all red in most females and many males of *clarconis* (and also in certain populations of *alpestris* and *linsleyi*).

The postocellar callosities are indistinct in some males, but males can be recognized by the well-developed foretarsal rake combined with broad vertex (width more than twice length).

The upper metapleuron is identical in *clarconis*, *galapagensis*, and *peruanus*, but in the latter two the vertex width is 1.3–1.5 (female) and 1.6–1.7× (male) length, the foretarsal rake is rudimentary or absent, the propodeal side of *galapagensis* is not ridged or indistinctly ridged, the female mesopleuron of *galapagensis* is indistinctly punctate, the male clypeus of *peruanus* is triangular, and its mandible is not dentate on the inner margin.

Description.—Scutal punctures no more than one diameter apart in some black males, but in most specimens punctures less than one diameter apart adjacent to margins and around admedian lines and two or three to several diameters apart in remaining U-shaped area. Metapleural flange narrow. Upper metapleuron with a few simple, longitudinal ridges before propodeal spiracle, at most with rudimentary, oblique ridge beneath anterior end of flange. Propodeum finely sculptured between dorsum and side. Basal tooth of hindcoxa low, obtuse.

Vestiture not obscuring or partly obscuring sculpture between antennal socket and orbit.

Gaster red (except tergum I black basally) to all black; black except reddish apically in females from San Nicolas Island, California, and in a female from junction of Springs Road and Highway 97, California. Terga I–IV (I–V in male) silvery fasciate apically). Wings almost hyaline to moderately infumate.

♀.—Clypeal width 2.8–3.2× length; bevel shorter than basomedian area; lip arcuate, without mesal projection. Dorsal length of flagellomere I 1.7–1.9× apical width. Vertex width 1.9–2.2× length. Frons distinctly punctate to rugose. Length 6.0–7.5 mm.

Setal length about 1.7 MOD on vertex and about 1.3 MOD anterolaterally on scutum (about 1.6 in specimens from Needles and Palo Verde, California, from Willcox area, Arizona, and in some specimens from Tombstone area, Arizona).

♂.—Clypeal width 3.1–3.3× length; lip evenly arcuate to slightly sinuate; corners prominent but obtuse, closer to antennal socket than to each other or equidistant. Frons punctate to punctatorugose. Vertex width 2.1–2.6× length. Sterna pubescent throughout. Foretarsus with rake; outer apical spine of foretarsomere II longer than tarsomere III. Length 4.5–6.5 mm.

Setal length about 1.3–1.7 on vertex and about 1.0 MOD anterolaterally on scutum (but varying from 1.2 to 1.6 in black specimens from Needles, California, and about 1.7 in specimens from Willcox area, Arizona, and from Percha Dam State Park, New Mexico).

Discussion.—The holotype female of *clarconis* differs from other specimens examined in having a finely punctate mesopleuron (most interspaces broader than punctures), evanescent ridges on the propodeal side, and the scutal setae 1.3 MOD long anterolaterally. Since no similar specimen has been found, and because other characters are identical, I regard the specimen as an individual variant, and therefore conspecific with other specimens studied, including the holotype of *plesius*, and the names *clarconis* and *plesius* as synonyms.

Life History.—Evans (1970) observed nesting habits of this species in Jackson Hole, Wyoming (as sp. near *linsleyi*), and Elliott and Kurczewski (1985) in St. Anthony, Idaho. Completion of the nest is followed by an orientation flight. The nest is temporarily closed when the wasp is hunting. The female walks with prey or, if the prey are small, she carries them in a series of short flights. They hold prey with their mandibles by the base of the antennae. Prey are nymphs of the acridids *Melanoplus foedus* Scudder, *Melanoplus sanguinipes* (Fabricius), and a third species which probably is *Chloealtis conspersa* (Harris). The female drops her prey near the nest entrance, opens it, enters, reappears headfirst, and pulls the grasshopper inside by its antennae. Three to six prey are stored per cell. The nest has one or two cells. The egg is deposited on a prey's prosternum, transversely behind the front coxae.

Geographic Distribution (Fig. 108).—Rocky Mountains west to the Pacific Coast, from southwestern British Columbia to Baja California Norte and southern New Mexico, also Kansas.

Material Examined.—637♀, 645♂.

Records (b: gaster black).—CANADA. **British Columbia:** Comox (b).

UNITED STATES. ARIZONA: **Cochise:** 2 mi NE Portal, 14 mi W Tombstone, 3 mi E Willcox (also 4 mi S). **Maricopa:** Tempe. **Santa Cruz:** Sonoita. **Yavapai:** Cottonwood. CALIFORNIA: **Alameda:** Sycamore Grove Regional Park. **Alpine:** 1 mi E Carson Pass, Hope Valley, Red Lake. **Butte:** 20 mi NE Yuba City. **Contra Costa:** Antioch, Danville (b). **El Dorado** (partly b). **Fresno:** Fresno (also 25 mi E), Huntington Lake. **Glenn:** Plaskett Meadows. **Humboldt** (partly b). **Imperial:** Palo Verde (partly b). **Inyo:** Deep Springs, Little Lake, Westgard Pass. **Kern:** Dove, Piute Mts., Short Canyon. **Lassen:** Hallelujah Junction (partly b). **Los Angeles. Marin** (some b). **Mariposa:** Mariposa, Wawona. **Mendocino** (some b). **Merced:** 2 mi S Hilmar. **Modoc:** 5.5 mi E Cedarville (b). **Mono** (partly b). **Monterey. Napa:** 4 mi NW Berryessa, Samuel Springs. **Nevada:** Boca, Sagehen Creek near Hobart Mills (partly b). **Orange:** Irvine Lake. **Placer:** Carnelian Bay on Lake Tahoe (partly b), Foresthill, 4 mi S Rocklin. **Plumas:** Chilcoot (b), 4 mi W Quincy. **Riverside. Sacramento. San Benito:** Pinnacles National Monument. **San Bernardino:** Afton Canyon, Baldy Mesa, Big Bear Lake, Cajon Junction (also 4 mi W), Kramer Junction, Needles (also 20 mi N), Phelan, Twentynine Palms, Wildwood Canyon (5 mi E Calimesa), 3 mi SE Yucaipa. **San Diego. San Francisco** (b): San Francisco (Baker Beach, Laguna Puerca, Lake Merced, Lobos Creek, Lone Mtn., Marine Hospital, Presidio Park). **San Luis Obispo. San Mateo:** Redwood City, San Bruno Mts. (b). **Santa Barbara:** San Miguel Island (b), Santa Rosa Island. **Santa Cruz:** Felton, Lockhart Gulch (5 mi E Mt. Hermon). **Shasta:** 3 mi SW Old Station (partly b), Redding (b). **Sierra** (some b). **Siskiyou** (some b). **Sonoma** (some b). **Stanislaus:** Turlock. **Sutter:** Nicolaus. **Trinity:** Eagle Creek, Hayfork, Junction City. **Tuolumne:** Pinecrest, Poopanut Valley (Yosemite National Park), Tuolumne. **Ventura:** including San Nicolas Island (b). **Yolo:** Davis (partly b), Elkhorn Ferry, 5 mi SW Winters. **Yuba:** 18 mi NW Marysville, Smartville. COLORADO: **Weld:** Roggen (b). IDAHO: **Bear Lake:** Bear Lake. **Franklin:** 3 mi NW Preston. **Fremont:** St. Anthony (partly b), 6 mi NW St. Anthony (partly b). **Lincoln:** Dietrich Butte, Shoshone (also 18 mi E). **Owyhee:** 6.3 mi SE Murphy. KANSAS: **Clark:** —. **Douglas:** Lawrence. NEVADA: **Carson City:** Carson City (b). **Churchill:** Carson Sink, Fallon. **Clark:** Riverside. **Douglas:** Spooners Lake N junction Highway 28 (partly b). **Elko:** 25 mi S Elko (b). **Esmeralda:** 6 mi N 2 mi W Fish Lake. **Humboldt:** Orovada, Winnemucca (partly b). **Mineral:** Teels Marsh sand dunes. **Washoe** (some partly b). **White Pine:** —(b). NEW MEXICO: **Dona Ana:** 12 mi N Las Cruces, Mesilla Park. **Sierra:** Percha Dam State Park. OREGON: **Benton:** Corvallis (b), 10 mi S Corvallis (b). **Deschutes:** Smith Rock State Park. **Douglas:** Winchester Bay (b). **Jackson:** Laurelhurst State Park (b), Rogue River. **Lane:** Florence. **Lincoln:** Newport (b). **Umatilla:** Hermiston. **Wasco:** 7 mi E The Dalles (b). UTAH: **Cache:** Cornish (partly b), Logan (partly b). **Emery. Kane:** Kanab. **Millard:** 15 mi N Delta, 5 mi W Hatton, Kanosh (partly b). **Rich:** south shore of Bear Lake (b). WASH-

INGTON: **Jefferson:** Port Townsend (b). **Pacific:** Grassy Island (b). Nahcotta (b). WYOMING: **Carbon:** Rawlins (b). **Converse:** Glenrock (partly b). **Lincoln:** 18 mi S Jackson (b). **Sweetwater:** Rock Springs (partly b). **Teton:** Hoback Junction (b). Moran (partly b).

MEXICO: **Baja California Norte:** Cataviña (also 27 mi SE), 0.9 mi S El Cóndor, 4 mi S Santa Maria, Santa María Beach (San Quintín Bay).

Tachysphex antillarum Pulawski

(Figure 110)

Tachysphex antillarum Pulawski, 1974*a*:44, ♀, ♂. ! Holotype: ♀, Puerto Rico: Isla Verde (USNM).—Bohart and Menke 1976:272.

DIAGNOSIS.—*Tachysphex antillarum* has distinctive upper metapleural structures: an oblique carina beneath the fore end of the flange, and a prespiracular carina that extends from about midlength of the flange to the the metapleural hindmargin and is not angulate posteriorly. The male forefemur is entire, like *quisqueyus*, but unlike the other species of the *terminatus* group.

DESCRIPTION.—Frontal punctures well defined. Scutum punctures less than one diameter apart, but a few of them about one diameter apart. Metapleural flange broad; upper metapleuron with low, oblique carina beneath front end of flange, and with prespiracular carina that extends from about the midpoint of the flange to the metapleural hindmargin (carina not angulate posteriorly). Propodeum coarsely sculptured between dorsum and side. Basal tooth of hindcoxa large.

Vestiture obscuring integument from most angles between antennal socket and orbit.

Gastral segments I–IV black, remainder red. Terga I–IV silvery fasciate apically. Wings almost hyaline.

♀.—Clypeal width 3.2–3.4 × length; bevel about as long as basomedian area; lip sinuate, slightly broadened mesally. Dorsal length of flagellomere I 1.7–1.9 × apical width. Vertex width 1.8 × length. Length 6.5–7.0 mm.

Length of setae about 1.3 MOD on vertex, 0.8 MOD on scutum anterolaterally.

♂.—Clypeal width 3.7 × length. Dorsal length of flagellomere I 1.0–1.2 × apical width. Vertex width 2.25 × length. Sterna II–IV with glabrous, apical depression. Forefemur not emarginate. Foretarsus with rake; outer apical spine of foretarsomere II slightly longer than tarsomere III. Length 5.0–5.5 mm.

Setae length about 1.3 MOD on vertex, about 1.0 MOD on scutum anterolaterally.

GEOGRAPHIC DISTRIBUTION (Fig. 110).—Cuba, Puerto Rico.

MATERIAL EXAMINED.—3♀, 1♂, paratypes (CAS).

RECORDS (Pulawski 1974*a*).—CUBA **Habana:** Jibacoa. **Las Villas:** Ciénega de Zapata. **Pinar del Rio:** Guane, Pinales del Viñares.

PUERTO RICO: Isla Verde (airport).

Tachysphex ruficaudis (Taschenberg)

(Figures 109, 110)

Tachytes ruficaudis Taschenberg, 1870:12, ♀. ! Lectotype: ♀, Brazil: Nova Friburgo (Zool. Inst. Halle, Germany), designated by R. Bohart *in* Pulawski 1974*a*:37.—In *Tachysphex*. Jörgenson 1912:291; Pulawski 1974*a*:37 (full bibliography); Bohart and Menke 1976:276.

Tachytes pullulus Strand, 1910:169, "♀" = ♂. ! Lectotype: ♂, Paraguay: Villa Mora or Asunción (Zool. Mus. Berlin), designated by R. Bohart *in* Pulawski 1974*a*: 37. Synonymized by R. Bohart *in* Pulawski 1974*a*:37.

DIAGNOSIS.—*Tachysphex ruficaudis* can be recognized by the continuous carina (or, in some specimens, a few longitudinal ridges) starting beneath the anterior end of the metapleural flange

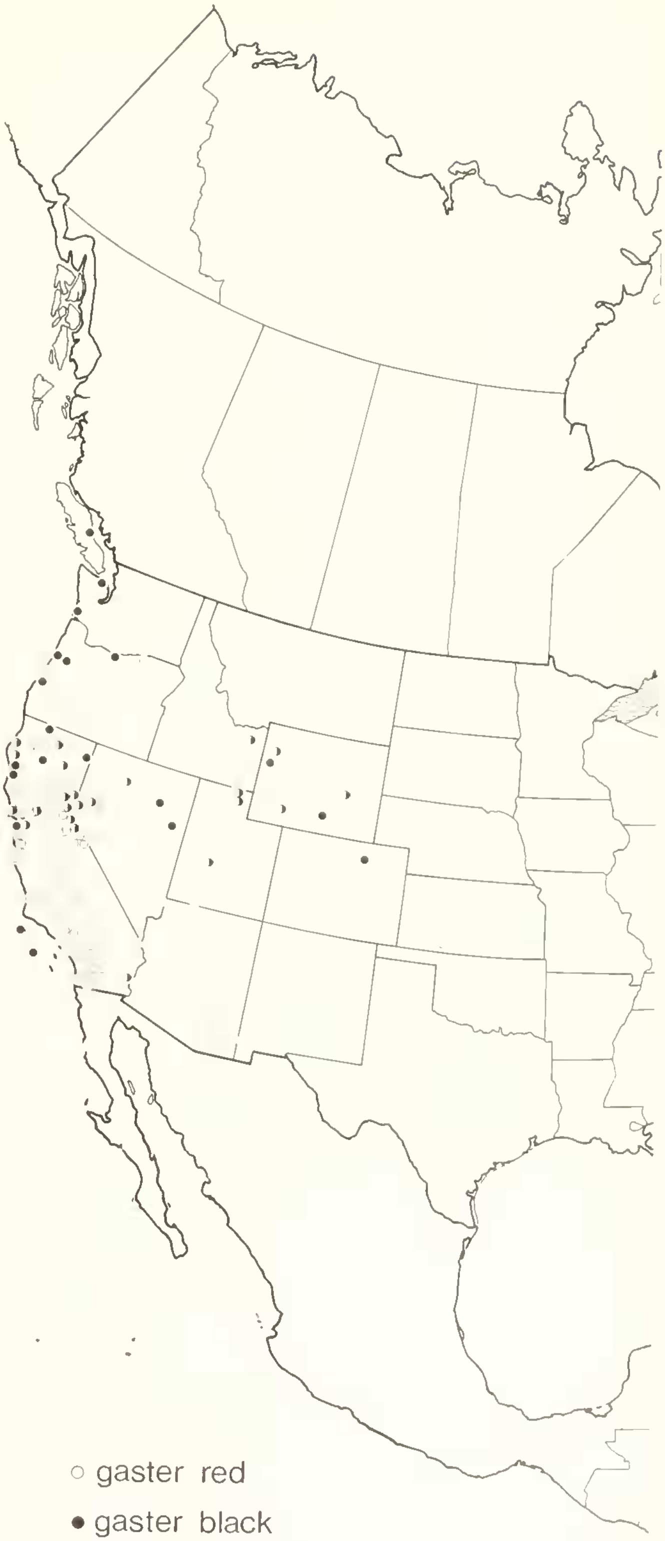

FIGURE 108. Geographic distribution of *Tachysphex clarconis* Viereck.

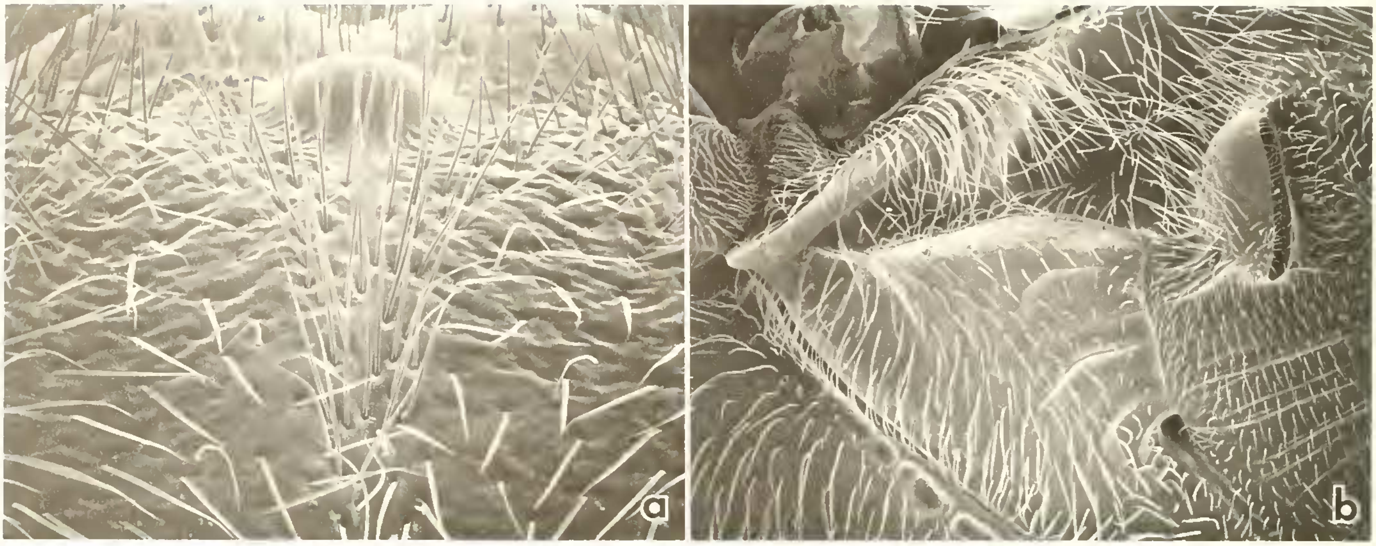

FIGURE 109. *Tachysphex ruficaudis* (Taschenberg), female: a—frons adjacent to midocellus, b—upper metapleuron, lateral view.

and ending before the propodeal spiracle (Fig. 109b). The broad metapleural flange distinguishes it from *claricornis*, *galapagensis*, and *peruanus*. Unlike other species of the *terminatus* group (except Bahamian *similis*), the mesopleural punctures of most *ruficaudis* are several diameters apart. The absence of a foretarsal rake distinguishes males of *ruficaudis* from other species of the group except *galapagensis*, *peruanus*, most *apicalis*, and some *linsleyi*.

DESCRIPTION.—Scutal punctures less than one diameter apart adjacent to margins and around admedian lines, and one to three to several diameters apart in remaining U-shaped area. Metapleural flange broad; upper metapleuron with one longitudinal carina (with a few longitudinal ridges in some individuals) that starts beneath anterior end of flange and ends before propodeal spiracle (Fig. 109b); carina obtusely angulate posteriorly in some Argentinian females; oblique carina beneath fore end of flange becoming higher toward flange, but abruptly lowering at attachment. Propodeum coarsely sculptured between dorsum and side in nearly all females and most males. Basal tooth of hindcoxa well developed.

Vestiture not obscuring or only partly obscuring sculpture between antennal socket and orbit.

Gastral terga I–IV (I–VI in some males) silvery fasciate apically. Wings moderately infumate.

♀.—Clypeal width 3.0–3.4 × length; lip evenly arcuate, mesally with small, obtuse projection in nearly all specimens. Dorsal length of flagellomere I 2.1–2.5 × apical width. Frons microrugose or closely punctate, with finely rugose interspaces (Fig. 109a). Vertex width 2.0–2.6 × length. Mesopleural punctures fine, several diameters apart (but large, less than one diameter apart in some Bolivian and Argentinian populations). Length 6–9 mm.

Setae length about 1.7–2.3 MOD on vertex, about 2.0 MOD anterolaterally on scutum.

Gaster with two or three apical segments red, all black in many specimens from Bolivia and south of the Tropic of Capricorn.

♂.—Clypeal width 3.2–3.6 × length; lip regularly arcuate, lateral corners sometimes slightly prominent, closer to antennal socket than to each other (sometimes equidistant). Frontal interspaces dull or shiny (occasional specimens), smooth or finely rugose. Vertex width 2.6–3.3 × length. Mesopleural punctures less than to much more than one diameter apart. Sterna III–VI glabrous or sparsely pruinose. Foretarsus mainly without rake, but some specimens with one or two preapical spines on forebasitarsus (spines shorter than basitarsal width); outer apical spine of foretarsomere II equal to corresponding inner spine or slightly longer. Length 5.0–6.5 mm.

Setae length about 2.0–2.5 MOD on vertex, about 1.7 MOD anterolaterally on scutum.

Gaster usually black, two apical segments reddish in some specimens.

GEOGRAPHIC DISTRIBUTION (Fig. 110).—Primarily a Neotropical species that invades the United States in Arizona and southern California. In the Caribbean Islands it only occurs in Jamaica. In South America it extends southward to 40°S.

MATERIAL EXAMINED.—60♀, 31♂ from North and Central America (CAS, CIS, CNC, ESCA, HKT, KU, LACM, MCZ, NYSU, SDNH, TAM, UAE, UAT, UCD, UCR, UIM, USU).

RECORDS.—UNITED STATES: ARIZONA: **Coconino:** Oak Creek Canyon (1♀, TAM; 1♂, UAT). **Graham:** Bonita Creek (1♂, UAT). **Pima:** Molino Basin in Santa Catalina Mts. (1♂, UAT), Sabino Canyon in Santa Catalina Mts. (2♂, UCD), Tucson (1♂, CAS; 4♂, 2♂, UAT; 1♂, UI). **Pinal:** 3 mi W Superior (6♂, 3♂, CAS; 1♀, UAT). CALIFORNIA: **Riverside:** Andreas Canyon (1♂, UCD), Riverside (2♀, ♂, UCR). **San Diego:** La Mesa (1♂, SDNH), San Diego River (1♂, SDNH).

MEXICO: **Chiapas:** Montebello National Park, Suchiapa. **Jalisco:** Chamela, Estanzuela (40 km W Ameca), 15 mi NE Guadalajara, Puerto Vallarta, Tecolotlan. **Morelos:** 7.5 mi S Yautepec. **Nayarit:** Huajicori on River Acaponeta, San Blas. **Nuevo Leon:** 7 mi W El Cercado. **Quintana Roo:** Felipe Carillo Puerto (19°35′N, 88°03′W), Vallarta (17 km N Puerto Morelos). **Oaxaca:** Palomares. **San Luis Potosi:** El Naranjo El Salto, Tamazunchale. **Sinaloa:** Chupaderos, 54 mi S Culiacan, 8 mi SE Elota, Tabala, 20 mi E Villa Union. **Sonora:** Alamos, Cócorit, E Yaqui River (35 air km WSW Sahuaripa). **Tamaulipas:** 15 mi N Llera. **Veracruz:** 30 mi S Acayucan, Atoyac, Cordoba, Coscomatepec, Fortin de las Flores, Orizaba, Puente Nacional. **Yucatan:** Uxmal.

CENTRAL AMERICA: BELIZE: Belize. COSTA RICA: 9 mi NW Esparta, Turrialba. EL SALVADOR: Parque Nacional del Cerro Verde, Quezaltepeque. PANAMA: Chiriqui (Potrerillos), La Chorrera, Portobelo, Taboga Island (Panama Province). **Canal Zone:** Barro Colorado, Cerro Cobre, Culebra–Arijan Trail, Empire.

JAMAICA: **St. Thomas Parish:** Yallahs (1♂, CAS).

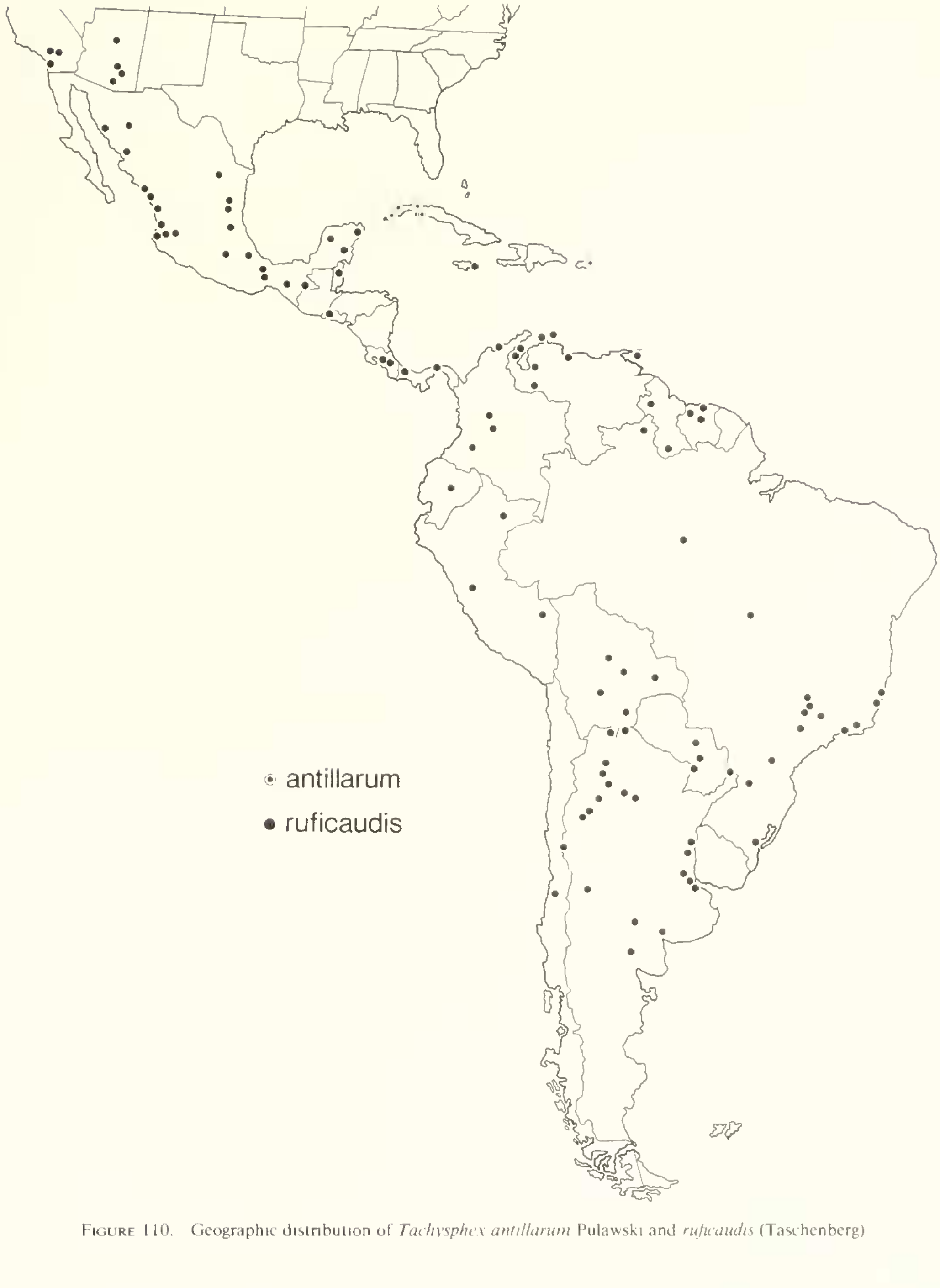

FIGURE 110. Geographic distribution of *Tachysphex antillarum* Pulawski and *ruficaudis* (Taschenberg)

SOUTH AMERICA (localities listed in Pulawski 1974*a* are not repeated here): ARGENTINA: **La Pampa:** Sierra Lihuel Calel. COLOMBIA. **Cundinamarca:** 11 mi E Caqueza, Tolima Armero. PARAGUAY: San Pedro Caroro–Rio Ypane. PERU **Huanuco:** Huánuco TRINIDAD AND TOBAGO **Trinidad:** Simla Field (Arima Valley). VENEZUELA **Aragua:** Ocumar de la Costa. **Barinas:** 32 km E El Canton. **Falcon:** Peninsula Paraguana (Pueblo Nuevo). **Merida:** 15 km W Lagunillas. **Trujillo:** Sabana Grande. **Zulia:** Carrasquero, 32 km SW Machiques. Rio Palmar 15 km NE Rosario, Rosario. **Curaçao:** Willemstad

Tachysphex alpestris Rohwer

(Figures 111, 115)

Tachysphex foxii var. *alpestris* Rohwer, 1908:223, ♀. ! Holotype: ♀: Colorado: Teller Co.: Florissant (USNM).—As *Tachysphex alpestris* G. Bohart 1951:950; Bohart and Menke 1976:272, Krombein 1979:1630, Elliott and Kurczewski 1985:294. Rust et al. 1985:46.

Tachysphex terminatus: Evans 1970:491, corrected to *Tachysphex alpestris* by Kurczewski and Evans 1986:270; Elliott and Kurczewski 1970:103 (part).

DIAGNOSIS.—*Tachysphex alpestris* has a distinctive prespiracular prominence on the upper metapleuron: the prominence is low, obtusely angulate in side view, with the posterolateral margin markedly shorter than the anterior margin (Fig. 111b–d). Some *linsleyi* have a similar metapleuron and may be difficult to distinguish from *alpestris*, although either the prominence or the oblique carina is higher than in *alpestris* (most *linsleyi* have a distinctive prespiracular prominence; see that species for details). Wing color is also diagnostic: wings are hyaline in *hinsleyi* and infumate to hyaline in *alpestris*. In *clarconis*, the metapleural flange is narrower than in *alpestris*, and the prominence is absent.

The metapleuron is similar in *alpestris* and the Caribbean species *antillarum*, but in the latter there is a short, nonangulate carina instead of a prominence; the clypeal lip of the female has a short, median projection; and the male forefemur is entire.

Description.—Frons punctate (Fig. 111a), but punctures ill defined in some specimens. Scutal punctures less than one diameter apart adjacent to margins and around admedian lines, but two or three to several diameters apart in remaining U-shaped area. Upper metapleuron, in front of propodeal spiracle, with low prominence that is obtusely angulate in side view (Fig. 111b, d), prominence consisting of a long anterior carina and two short posterior carinae (one carina in some specimens) that have a common apex (Fig. 111c); flange broad, oblique carina beneath its anterior end low, in most specimens becoming higher toward flange but lowering at attachment, absent in some specimens. Propodeum finely sculptured between dorsum and side. Basal tooth of hindcoxa large or (some specimens) low, obtuse.

Vestiture not obscuring integument between antennal socket and orbit (except some populations from Nevada and California).

Terga I–IV or I–V silvery fasciate apically. Wings moderately infumate, hyaline in some specimens.

♀.—Clypeal width 2.6–3.0 × length; bevel shorter than basomedian area; lip arcuate, without median projection. Dorsal length of flagellomere I 1.5–1.8 × apical width. Vertex width 1.8–2.2 × length. Length 6–9 mm.

Setal length about 2.0 MOD on vertex and about 1.3 MOD on scutum anterolaterally.

Gaster black (British Columbia), with two or three apical segments red (most United States populations) or all red (Desert Center and Borrego Valley, California; Mexico; Costa Rica).

♂.—Clypeal width 2.6–3.1 × length; lip arcuate to straight; corners obtuse to acute, closer to antennal socket than to each other or slightly closer to each other. Vertex width 1.9–2.6 × length. Sterna pubescent throughout or sterna II–VI glabrous apically. Foretarsus with rake; outer apical spine of foretarsomere II longer than tarsomere III. Length 4.5–7.0 mm.

Setal length about 1.7 MOD on vertex and 1.0–1.5 MOD on scutum anterolaterally.

Gaster black, rarely with red apical segment, all red in most Mexican and Costa Rican specimens.

Discussion.—*Tachysphex alpestris* may be a geographic form of *terminatus*. Both species are similar and differ mainly in the shape of the prespiracular prominence of the upper metapleuron. In Canada and the United States they are nearly allopatric (*alpestris* is western, *terminatus* is eastern), but they overlap in Alberta, Colorado, New Mexico, and Arizona. In Mexico and Central America, *alpestris* seems to be restricted to coastal habitats, while *terminatus* is also found inland. The species do not intergrade morphologically. The only possible intermediate was found in Playa Matanchen, Mexico. Of the five males from that locality (MCZ), three have a sharp prespiracular prominence (as in *terminatus*), one has an obtuse prominence (as in *alpestris*), and one an intermediate prominence. Otherwise these individuals are very similar to each other and look like representatives of a single population.

Life History.—The specimens from Jackson Hole, Wyoming, observed by Evans (1970) actually are *alpestris*, not *terminatus* as stated by the author (Kurczewski and Evans 1986). Prey transport was by flying. Two nests examined had one and three cells, respectively. The cells were placed 3.0–4.5 cm below the soil surface. The burrow was temporarily closed during the wasp's absence. Two to 13 immature grasshoppers were used per cell, all *Chorthippus curtipennis* (Harris), 5–9 mm long (mean 6.5 mm). Elliott and Kurczewski (1985) report a nymphal acridid, *Oedaleonotus* sp., as prey.

Three females examined were pinned with acridid prey: (1) one without locality label (CAS), determined as *terminatus* by F. E. Kurczewski, with two young nymphs of *Melanoplus* sp., 7.0 and 8.5 mm long, det. A. B. Gurney; (2) one from Sierra Valley, California (UCD), with four young nymphs of *Melanoplus*, probably *sanguinipes* (Fabricius), det. D. C. F. Rentz; and (3) one from the Arcata area, California (CAS), with a nymph, probably of *Microtes helferi* (Strohecker), det. D. Otte.

Geographic Distribution (Fig. 115).—Rocky Mountains to the Pacific Coast, also Manitoba; north to Alaska, south to Costa Rica. In the United States and Canada it replaces *terminatus* in the West.

Material Examined.—794♀, 850♂.

Records.—CANADA. **Alberta:** Drumheller, Edmonton, Lethbridge, Medicine Hat, 12 km SW Orion, Slave Lake, Writing-on-Stone Provincial Park. **British Columbia:** Comox, Lillooet, McGillivray Creek (Game Reserve near Chilliwack), Oliver, Penticton, Seton Lake, Vancouver, Vernon. **Manitoba:** Cormorant Lake. **Northwest Territories:** Rae, Yellowknife. **Saskatchewan:** Elbow, Prince Albert, Saskatoon.

UNITED STATES. ALASKA. Alaska Highway mi 1246: 63°N, 142°W (22♂, NYSU, listed as *terminatus* by Elliott and Kurczewski 1978). ARIZONA. **Cochise:** Skelton Canyon (Peloncillo Mts.). **Coconino:** Flagstaff, 10 mi W Jacob Lake. CALIFORNIA. **Alameda. Alpine. Contra Costa. Del Norte:** Crescent City, Point St. George. **El Dorado:** Echo Lake, Grass Lake, Icehouse Road (24 air mi ENE Placerville). **Fresno. Humboldt. Inyo. Kern:** Short Canyon (7 mi NW Inyokern). **Lassen. Los Angeles. Marin. Mendocino. Modoc. Mono. Monterey. Nevada:** Boca, Olympia Lake, Sagehen Creek near Hobart Mills. **Orange:** Newport Beach, Santa Ana River. **Placer:** Carnelian Bay (Lake Tahoe), Forest Hill. **Plumas:** Blairsden, Greagle, Quincy. **Riverside. Sacramento:** Folsom, Sacramento. **San Bernardino:** 1–2 mi S Cajon Pass, Green Canyon (SE Sugarloaf), Phelan, Southern Fork of Santa Ana River, Thurman Flats Picnic Area, Victorville. **San Diego. San Francisco:** San Francisco (Baker Beach, Fort Funston, Laguna Puerca, Lake Merced, Lobos Creek, Presidio Park). **San Joaquin:** Corral Hollow (8 mi N Tracy). **San Luis Obispo. San Mateo. Santa Barbara:** including Santa Cruz Island. **Santa Clara:** Alum Rock, San Jose, Stanford University. **Shasta:** 2 mi W Shingletown. **Sierra. Siskiyou. Sonoma:** Bodega Bay, Mesa Grande. **Stanislaus:** Del Puerto Canyon, Turlock. **Trinity:** Coffee Creek Ranger Station, Hayfork Ranger Station, Mirror Lake. **Tulare. Tuolumne. Ventura:** including Santa Barbara Island. **Yolo:** Davis, Elkhorn Ferry, 2 mi E Woodland. **Yuba:** Challenge. COLORADO. **Alamosa:** Great Sand Dunes. **Boulder:** Boulder. **Chaffee:** 1.5 mi N Salida. **Douglas:** 20 mi S Denver. **Eagle:** State Bridge near Bond. Estes Park. **Garfield:** Rifle. **Gunnison:** 18–24 mi E Paonia. **Larimer. Mesa:** W end of Grand Mesa. **Moffat:** Greystone. **Montezuma:** 3 mi W Arriola. **Park:** Wilkerson Pass. **Routt:** 7 mi E Hayden. **Teller:** Florissant. **Weld:** Owl Creek 11 and 19 mi NE Nunn. IDAHO. **Bannock:** Pocatello. **Bear Lake:** Bear Lake, Paris. **Blaine:** 9 mi SW Bellevue, 3 mi NE Carey. **Bonner:** Walsh Lake Samuels. **Boundary:** Highway 95 (3 mi S British Columbia). **Butte:** Craters of the Moon National Monument. **Canyon:** Melba, Murphy, Notus, Parma. **Cassia:** Emery Canyon (12 mi SE Oakley), Sublette. **Custer:** Morgan Creek (5 mi NW Salmon River), Salmon River (2 mi N Challis), 5 mi NE Stanley. **Elmore:** Mayfield. **Franklin:** 3 mi NW Preston. **Fremont:** St. Anthony Sand Dunes. **Gooding:** 1 mi NE Gooding. **Idaho:** Lowell. **Jefferson:** 6 mi N Roberts. **Jerome:** Hunt Project (2 mi N Hazelton). **Kootenai:** Lane. **Latah:** 5 mi N Bovill, Idlers Rest near Moscow. **Nez Perce:** Lewiston. **Oneida:** Black Pine Canyon, Holbrook Sand Dunes. **Owyhee:** 17 mi W Silver City, Walter's Ferry. **Twin Falls:** Rogerson, Twin Falls. **Valley:** Darling's Flat (S Fork Salmon River), Donnelly. MONTANA. **Toole:** 27 mi E Shelby. NEBRASKA. **Madison:** Meadow Grove. NEVADA. **Churchill:** 1 mi W Eastgate, Fallon, 3 mi W Hazen. **Douglas:** Kingsbury Summit, Spooners Lake (N

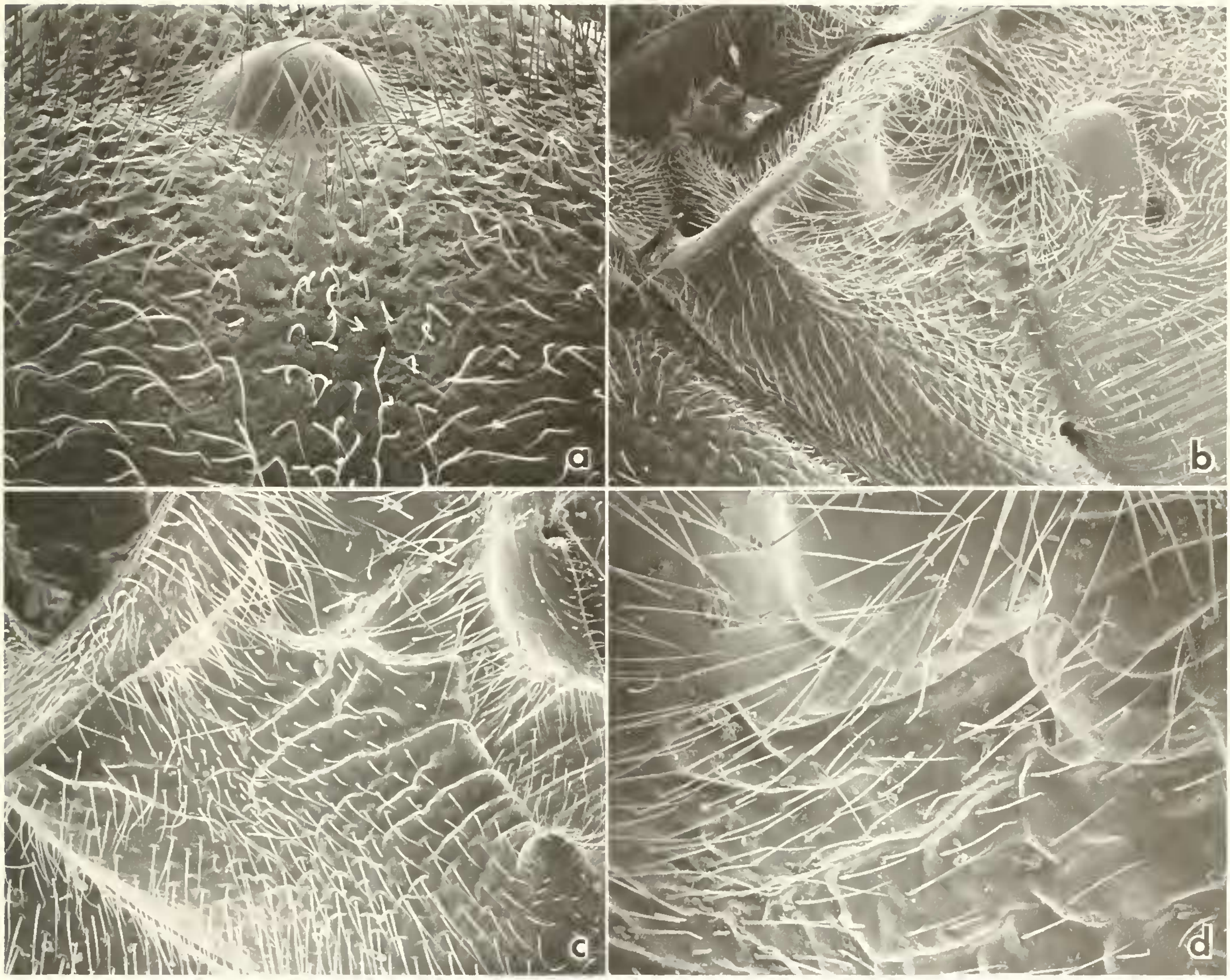

Figure 111. *Tachysphex alpestris* Rohwer, female: a—frons adjacent to midocellus; b—upper metapleuron, lateral view, c—same, top view, d—prespiracular prominence of upper metapleuron.

Junction Highway 28), Topaz Lake. **Elko. Eureka:** Boewowawe, Diamond Valley. **Humboldt:** Canyon Creek. Orovada. **Lander:** Austin. **Lincoln:** Panaca. **Nye:** 5 mi N Round Mt. **Pershing:** 7 mi E Oreana. **Storey:** Geiger Gd. **Washoe. White Pine.** NEW MEXICO. **Catron:** Pie Town. **Colfax:** Raton, 2 mi N Ute Park. **Sandoval:** Jemez Springs. **Taos:** Taos. OREGON: **Baker:** Cornucopia. **Coos:** —. **Crook:** Powell Butte. **Curry:** Gold Beach. **Deschutes:** Deschutes River 1 mi SW Pringle Falls, 9 mi E Redmond, Tumalo Res. **Douglas:** Winchester Bay. **Jackson:** Rogue River (Palmerton Arboretum). **Lake:** Drake Peak. **Lane:** Florence. **Lincoln:** Newport. **Linn:** Lost Lake. **Tillamook:** Rockway. **Union:** Union. UTAH: **Box Elder:** Fielding. **Cache. Duchesne:** 5.5 mi W Roosevelt. **Emery:** Huntington Creek, Wild Horse Creek W Goblin Valley. **Garfield:** Calf Creek, SSE Notom (Blind Trail Wash, Sweetwater Creek), Shootaring Canyon. **Juab:** Mt. Nebo. **Millard:** Delta, 5 mi W Hatton. **Rich:** Garden City, Logan Canyon summit. **Salt Lake:** Salt Lake City. **San Juan:** Blanding, Kane Springs (E Bridges National Monument). **Summit:** Coalville. **Uintah:** 17 mi S Bonanza, 6 mi N Vernal. **Utah:** Salem, Spanish Fork. **Washington:** Duncan Flats, Upper Deep Creek, Zion National Park. **Wayne:** Hanksville. **Weber:** Willard Basin. WASHINGTON: **King:** Richmond Beach, Seattle. **San Juan:** Argyle. **Thurston:** Olympia. **Walla Walla:** Mill Creek, Walla Walla. **Whitman:** Wawawai County Park. **Yakima:** Yakima River. WYOMING: **Fremont:** Kinnear. **Laramie:** 28 mi E Laramie. **Natrona:** Powder River. **Park:** Sunlight Basin N Cody. **Sublette:** 3 mi N Pinedale. **Sweetwater:** Farson (also 20 mi E), Granger, 12 mi S Green River. **Teton:** 6 mi N Jackson, Jackson Hole Biological Station (Moran), Pilgrim Creek, Snake River (5 mi S Elk).

MEXICO: **Baja California Norte:** 1 mi S El Cóndor, 15 mi E Ensenada, 6 mi N Laguna Hanson (Sierra Juárez). **Baja California Sur:** Todos Santos. **Chiapas:** Puerto Madero. **Jalisco:** Playa Cuitzamala 8 km S Careyes. **Nayarit:** Playa Matanchen near San Blas. **Sinaloa:** Mazatlán. **Tamaulipas:** Municipio Aldama, Rancho Nuevo, Barra Coma (1♀, CAS, 2♀, 1♂, FSCA). **Yucatan:** Progreso.

COSTA RICA: Limón.

Tachysphex linsleyi R. Bohart

(Figures 112, 113)

Tachysphex linsleyi R. Bohart, 1962:35, ♂, ♀. Holotype: ♂, Nevada: Churchill Co.: 1 mi W Eastgate (CAS).—Krombein 1967:393, Bohart and Menke 1976: 274, Krombein 1979:1931.

Diagnosis.—Most *linsleyi* can easily be recognized by the shape of the upper metapleuron: the oblique carina beneath the anterior end of the flange is partly translucent and expands to the outer edge of the flange or nearly so; and the prespiracular prominence of the upper metapleuron is funnel-shaped, partly translucent (Fig. 112a–c). Both structures vary in size and in some specimens they approach the condition found in *alpestris*.

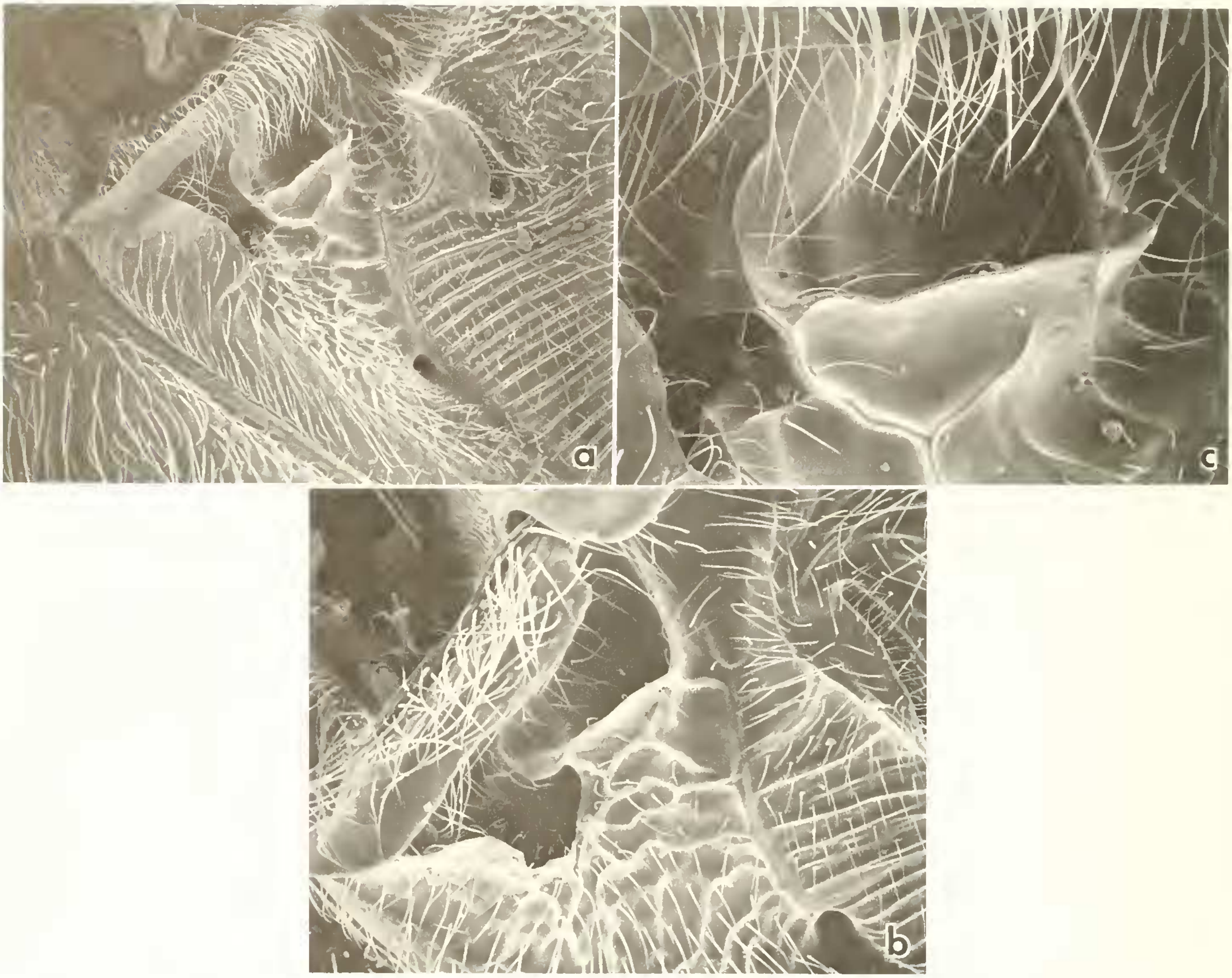

FIGURE 112. *Tachysphex linsleyi* R. Bohart, female: a—upper metapleuron, lateral view, b—same, top view, c—prespiracular prominence of upper metapleuron.

The hyaline wings of *linsleyi* help in recognition (wings hyaline to infumate in *alpestris*).

DESCRIPTION.—Frons with well-defined punctures. Scutal punctures less than one diameter apart adjacent to margins and around admedian lines, but about one to several diameters apart in remaining U-shaped area. Upper metapleuron with prespiracular prominence which consists of three carinae having a common apex (Fig. 112a–c): a long anterior carina, a long admedian carina, and a short posterior carina (the latter inconspicuous in some individuals); the anterior and admedian carinae in most specimens high and partly translucent, intersecting at an obtuse angle and forming a funnellike structure; these two carinae low, ridgelike in some specimens, only slightly higher than in *alpestris*; metapleural flange broad; oblique carina beneath its anterior end becoming higher toward flange, highest at the attachment; in many specimens it is largely translucent and as high as flange (its upper margin meeting outer margin of flange), but low, slightly higher than in *alpestris*, in some individuals. Mesopleural punctures well defined, less than one diameter apart (some punctures may be more than one diameter apart). Propodeum finely sculptured between dorsum and side. Basal tooth of hindcoxa large.

Vestiture totally obscuring sculpture between antennal socket and orbit.

Terga I–IV (female) or I–V (male) silvery fasciate apically. Wings hyaline.

♀.—Clypeus width 2.8–3.0 × length; lip arcuate, without median projection. Dorsal length of flagellomere I 1.5–2.2 × apical width. Vertex width 2.0–2.4 × length. Length 7–9 mm.

Setal length almost 2.0 MOD on vertex, about 1.7 MOD anterolaterally on scutum.

Gaster black, usually with three apical segments red, all black in two Arizona females: from Bouse (ASU) and Tucson (UAT); largely or all red in some California specimens; only segment I and part of II black in one of the females from Antelope Springs (CIS), in a single female seen from Desert Center (NYSU), and one from Anza (UCD); gaster all red in two females from Death Valley Junction (UCD), and a female from Tucson, Arizona (UAT).

♂.—Clypeal width 2.6–2.9× length; lip arcuate; corners distinct but not prominent, closer to each other than to antennal socket or equidistant. Vertex width 2.3–2.8× length. Terga II–VI glabrous apicomesally. Foretarsal rake present in most specimens, but absent in two males from Sierra de la Giganta, Baja California Sur (CAS); outer apical spine of foretarsomere II longer than foretarsomere III. Length 4.5–7.0 mm.

Setal length about 2.0 MOD on vertex, about 2.5 MOD anterolaterally on scutum.

Gaster black, three or four apical segments red; only segment I black in many specimens from Death Valley Junction, California.

LIFE HISTORY.—Krombein (1967) recorded unidentified acridid nymphs as prey of *linsleyi*. A female from Rodeo, New Mexico (UCD) is pinned with her prey, an immature acridid *Eremiacris pallida* (Bruner), determined by D. C. F. Rentz.

GEOGRAPHIC DISTRIBUTION (Fig. 113).—Western United States and Mexico, north to Washington and Idaho, south to central Mexico, east to Colorado and Texas.

MATERIAL EXAMINED.—290♀, 309♂ (on the 19♀, 4♂ paratypes from Eastgate, Nevada, 1♀ is actually *apicalis*, and 5♀, 1♂ are *alpestris*).

RECORDS.—UNITED STATES: ARIZONA. **Apache:** Eagar, Vernon. **Cochise. Coconino:** 15 mi N The Gap. **Gila:** Gila River 3 mi S Christmas. **Graham:** Roper Lake State Park (6 mi S Safford). **Maricopa. Mohave. Pima:** Santa Rita Mts., Tucson. **Pinal:** Maricopa, Superior (Boyce Thompson Arboretum). **Yavapai:** 7 mi E Cottonwood. **Yuma:** 5 mi SE Bouse, Parker. CALIFORNIA. **Fresno:** 3 mi N Pine Ridge. **Imperial:** Chocolate Mts. (Ogilby Road 3 mi S Junction Highway 78), Glamis. **Inyo. Lassen:** Hallelujah Junction. **Los Angeles:** 12 mi NE Pearblossom. **Mono:** Paradise Camp. **Riverside. Sacramento:** Sacramento. **San Bernardino. San Diego:** Borrego Valley, 10 mi NE Ramona. COLORADO: **Baca:** Two Buttes Reservoir. **Bent:** Hasty. **Garfield:** Rifle. **Larimer:** Fort Collins, Park Creek (20 km N Fort Collins). **Pueblo:** Pueblo. **Weld:** Owl Creek (11 mi NE Nunn). IDAHO. **Ada:** 12 mi NW Regina. **Canyon:** Marsing, 2 mi W Melba. **Cassia:** Murtaugh. **Elmore:** Hammett. **Franklin:** Preston. **Gooding:** Wood River 1 mi NE Gooding. **Oneida:** 5 mi NW Holbrook, Salyer Cow Camp, Stone Reservoir. **Owyhee:** 4 mi SW Bruneau. MONTANA: —. NEVADA. **Churchill:** 1 mi W Eastgate. **Clark:** 20 mi W Glendale, Grand Gulch Road 22 air mi S Mesquite. **Humboldt:** Orovada. **Lincoln:** Panaca. **Mineral:** —. **Nye:** 24 mi E Tonopah. **Washoe:** Patrick. NEW MEXICO: **Bernalillo:** Albuquerque. **Catron:** Pie Town. **De Baca:** Sumner Lake State Park. **Dona Ana:** Hatch, Las Cruces (also 15 mi N). **Eddy:** 5 mi N Carlsbad. **Hidalgo. Luna:** Cooks Mts. **McKinley:** Tohatchi. **Otero:** Alamogordo. **San Juan:** 43 mi S Shiprock. **Sierra:** Percha Dam State Park. **Socorro:** La Joya (20 km N Socorro). **Torrance:** Gran Quivira (town). OKLAHOMA. **Cimarron:** Black Mesa State Park. OREGON: **Deschutes:** 9 mi E Redmond. TEXAS. **Brewster:** Big Bend National Park, 1 mi W Lajitas. **Cameron:** Brownsville, Port Isabel. **Hudspeth:** McNary, 5 mi E Sierra Blanca. **Presidio:** 3 mi E Presidio. **Uvalde:** Nueces River. **Victoria:** Victoria. **Ward:** 1 mi S Grandfalls. UTAH. **Box Elder:** Promontory, 15 mi W Tremonton. **Cache:** Cornish. **Emery:** N Goblin Valley (Wild Horse Creek), 15 mi NW Woodside. **Garfield:** Blind Trail Creek SSE Notom, Calf Creek, Shootaring Canyon. **Grand:** Salt Valley NW Arches National Park. **Millard:** 12 mi W Fillmore. **San Juan:** 25 mi S Moab. **Tooele:** St. John. **Uintah:** SW Bonanza, Green River 5 mi NE Jensen. **Utah:** Goshen. **Washington:** Leeds Canyon, Paradise Canyon, Zion National Park. WASHINGTON: **Asotin:** Clarkston. WYOMING: **Natrona:** Powder River.

MEXICO: **Baja California Norte:** Cataviña, 7.6 mi San Vicente. **Baja California Sur:** 12 mi S Guillermo Prieto, 13 air km WNW La Purisima, 16 mi E Rosarito, 3.5 km WNW San Isidro, Sierra de la Giganta (22 km W Loreto), E edge of Sierra Placeres (27°35'N, 114°30'W), 11 mi NE Todos Santos. **Chihuahua:** 20 mi N Ciudad Camargo, Colonia Juárez, 9 mi S Hidalgo del Parral. **Coahuila:** San Pedro de las Colonias (also 25 mi SE). **Sinaloa:** 54 mi S Culiacan, 8 mi SE Elota. **Sonora:** 10 mi SE Alamos, 6 km NNW San Carlos. **Tamaulipas:** Matamoros (also 30 mi SE). **Zacatecas:** 9 mi N Ojocaliente.

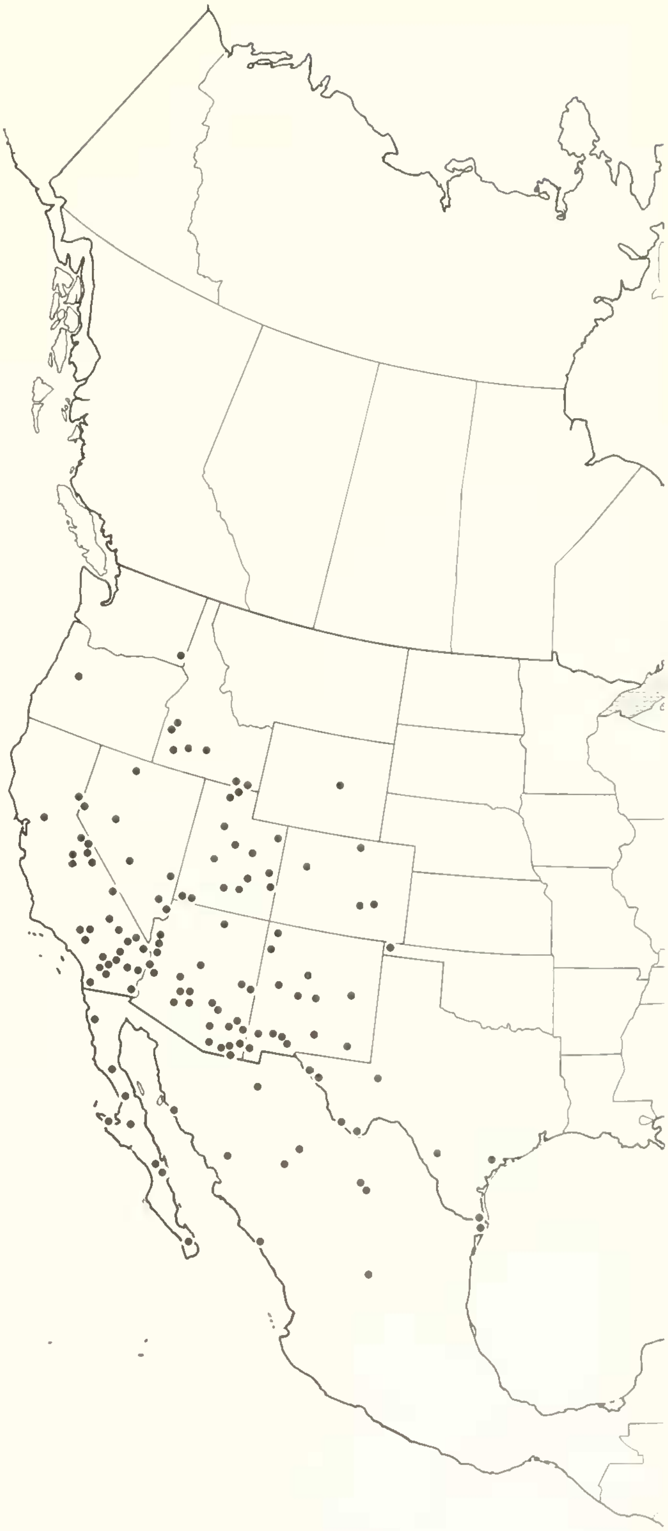

FIGURE 113. Geographic distribution of *Tachysphex linsleyi* R. Bohart.

Tachysphex quisqueyus sp. n.

(Figure 115)

Derivation of Name.—Quisqueyus is a neo-Latin adjective derived from Quisqueya, the oldest known name of Hispaniola (the island was so called by the Tano Indians, its original inhabitants); an allusion to the geographic distribution of this species.

Diagnosis.—*Tachysphex quisqueyus* is known only from Hispaniola and is the only member of the *terminatus* group found on that island. It shares with *antillarum* the nonemarginate male forefemur (emarginate basally in the other members of the *terminatus* group). It differs from *antillarum* in the structure of the upper metapleuron: the prespiracular prominence is high, toothlike, and the oblique carina beneath the fore end of the flange is high, conspicuous (prominence and oblique carina low, inconspicuous in *antillarum*). Three other species have metapleural structures similar to *quisqueyus*, but differ as follows (characters in parentheses refer to *quisqueyus*). In *apicalis*, the clypeus is narrow (clypeus broad, see Description below for the proportions) and the frons is shiny (frons dull); in *similis*, frontal punctures are indistinct, and the prespiracular prominence is sharp in most specimens (frontal punctures well defined, prespiracular prominence obtuse); in *terminatus*, the width of the female vertex is 2.0–2.2 × length, and the vestiture completely conceals the basal portion of the clypeus (vertex width in female 1.6–2.0 × length, clypeal vestiture not obscuring the integument). In addition, all or nearly all scutal punctures are less than one diameter apart in *quisqueyus* (scutum almost uniformly punctate), whereas in most specimens of the other three species the scutum is densely punctate along margins and behind admedian lines but sparsely punctate in the remaining U-shaped area.

Description.—Frontal punctures well defined. Scutal punctures in some specimens less than one diameter apart, or one or more diameters apart in a U-shaped area (a few largest interspaces up to two or three diameters). Upper metapleuron with large, toothlike prominence in front of propodeal spiracle (prominence similar to that of *terminatus*); flange broad; oblique carina beneath its anterior end becoming higher toward flange but abruptly lowering at its attachment. Propodeum finely sculptured between dorsum and side. Basal tooth of hindcoxa large.

Vestiture obscuring integument from most angles between antennal socket and orbit, but not obscuring clypeal integument. Setae length about 1.7 MOD on vertex, 1.3 MOD on scutum anterolaterally.

Gastral segments I–IV black, remainder red. Terga I–IV silvery fasciate apically. Wings weakly infumate.

♀.—Clypeal width 2.9–3.2 × length; lip arcuate. Dorsal length of flagellomere I 1.7–1.9 × apical width. Vertex width 1.7–2.0 × length. Length 5.5–7.5 mm.

♂.—Clypeus width 3.1–3.6 × length. Dorsal length of flagellomere I 1.25 × apical width. Vertex width 1.9–2.1 × length. Sterna pubescent throughout. Forefemur entire. Foretarsus with rake; outer apical spine of foretarsomere II longer than foretarsomere III. Length 3.5–6.0 mm.

Geographic Distribution (Fig. 115).—Hispaniola.

Material Examined.—Holotype ♀: Dominican Republic, Provincia Pedernales, Cabo Rojo, 5 Nov 1986, WJP (CAS, Type #15910).

Paratypes (13♀, 48♂): DOMINICAN REPUBLIC: **Distrito Nacional:** Haina, 18–24 May 1985, H. L. Dominguez (1♀, FSDA), 30 May 1985, LAS (2♀, FSCA), 1 and 8 Nov 1986, WJP (2♀, 7♂, CAS). **Monte Christi:** 9 km N Monte Christi, 17 June 1986, LAS and R. E. Woodruff (1♀, FSCA). **Pedernales:** Cabo Rojo, 4 and 5 Nov 1986, WJP (4♀, 38♂, CAS, 2♂, MCZ). **San Pedro de Macoris:** Boca del Soca, 13 June 1976, EEG (3♂, 1♀, FSCA).

Tachysphex terminatus (F. Smith)

(Figures 114–115)

Larrada terminata F. Smith, 1856:291, ♂. ! Lectotype: ♂, labeled "Trenton Falls, New York" (Oxford Univ. Mus., England), present designation.—Cresson 1862: 238, 1872:214, 1876:208.—In *Larra*: Patton 1881:389; Provancher 1882:50, 1883:633, 1887:267 (in key); Kohl 1885:248, Ashmead 1899:250; Cockerell 1900:144, J. Smith 1900:518, Harrington 1902:221, H. Smith 1908:382; J. Smith 1910:683, Williams 1914:172, 201; Rohwer 1916:687, 1917*b*:244; Mickel 1918:422, Rau and Rau 1918:144, Washburn 1918:223, Rau 1926:188; Bradley 1928:1009, Robertson 1928:195, 209, Brimley 1938:443, Rau 1946:10; Krombein 1950:267; G. Bohart 1951:953, Krombein 1952:93; Cooper 1953: 33, Krombein 1953*a*:295, 296, 330, 1953*b*:123, 132; Strandtmann 1953:49, Evans 1958:118 (larva), Krombein 1958*b*:100, 1958*c*:188, Kurczewski and Kurczewski 1963:146; Kurczewski 1966*a*:317, 1966*b*:436–453, Krombein 1967: 393, Kurczewski 1967:279, Kurczewski and Harris 1968:81; Kurczewski and Snyder 1968:28, nec Evans, 1970:491 (=*Tachysphex alpestris*); Miller and Kurczewski 1973:210; Steiner 1973:24, Elliott and Kurczewski 1974:725, Pulawski 1974*a*:41; Elliott and Kurczewski 1975:268, Bohart and Menke 1976:277; Elliott and Kurczewski 1978:103, Krombein 1979:1631; Finnamore 1982:107; Spofford and Kurczewski 1984:663, Spofford et al. 1986:350.

Larra minor Provancher, 1887:268, ♀, ♂. ! Lectotype: ♂, Ontario: Ottawa (Laval Univ., Quebec), designated by Gahan and Rohwer 1917:433. Synonymized by W. Fox 1894*a*:520 and G. Bohart 1951:953 (as syn. n.).

Diagnosis.—A conspicuous feature of *terminatus* is the toothlike prespiracular prominence on the upper metapleuron, with the anterior and the posterior margin about equal in length (Fig. 114b–d). A similar structure is found in *apicalis*, *quisqueyus* (see these species for differences), and in *similis*. In *terminatus* the metapleural prominence is broad in lateral view (narrow in most *similis*, Fig. 116d) and, in addition, frontal punctures of most specimens are well defined (ill defined in *similis*). In the female of *terminatus* the vertex width : length ratio is 2.0–2.2 (1.4–1.7 in *similis*), the anterolateral scutal setae are about 2.0 MOD (about 1.0 MOD in *similis*), and the setae entirely conceal integument between antennal socket and orbit (partly so in *similis*). The males of the two species are difficult to distinguish. In *terminatus*, the frontal punctures are well defined in most specimens (frons microrugose, with punctures ill defined or absent, in most *similis*); the vertex averages wider (width : length ratio 2.0–2.5, and 1.6–2.2 in *similis*), the anterolateral scutal setae are somewhat longer (about 2.0 MOD instead of about 1.3), and the integument between the antennal socket and orbit is totally concealed by setae in most specimens (not concealed in *similis*).

Description.—Clypeal width 3.0–3.2 × length (2.8 × in small females). All scutal punctures less than one diameter apart in some specimens (e.g., in a female from Washington, D.C., CAS), but in most individuals punctures less than one diameter apart adjacent to margins and around admedian lines, and one or two to several diameters apart in remaining U-shaped area. Upper metapleuron (Fig. 114c–d): flange broad; oblique carina beneath its anterior end becoming higher toward flange but abruptly lowering at its attachment, lamelliform in many specimens; prominence before propodeal spiracle conspicuous, consisting of three carinae which have a common apex: anterior and posterior carinae (which are about equal in length), and admedian carina. Propodeum finely sculptured between dorsum and side. Basal tooth of hindcoxa well developed.

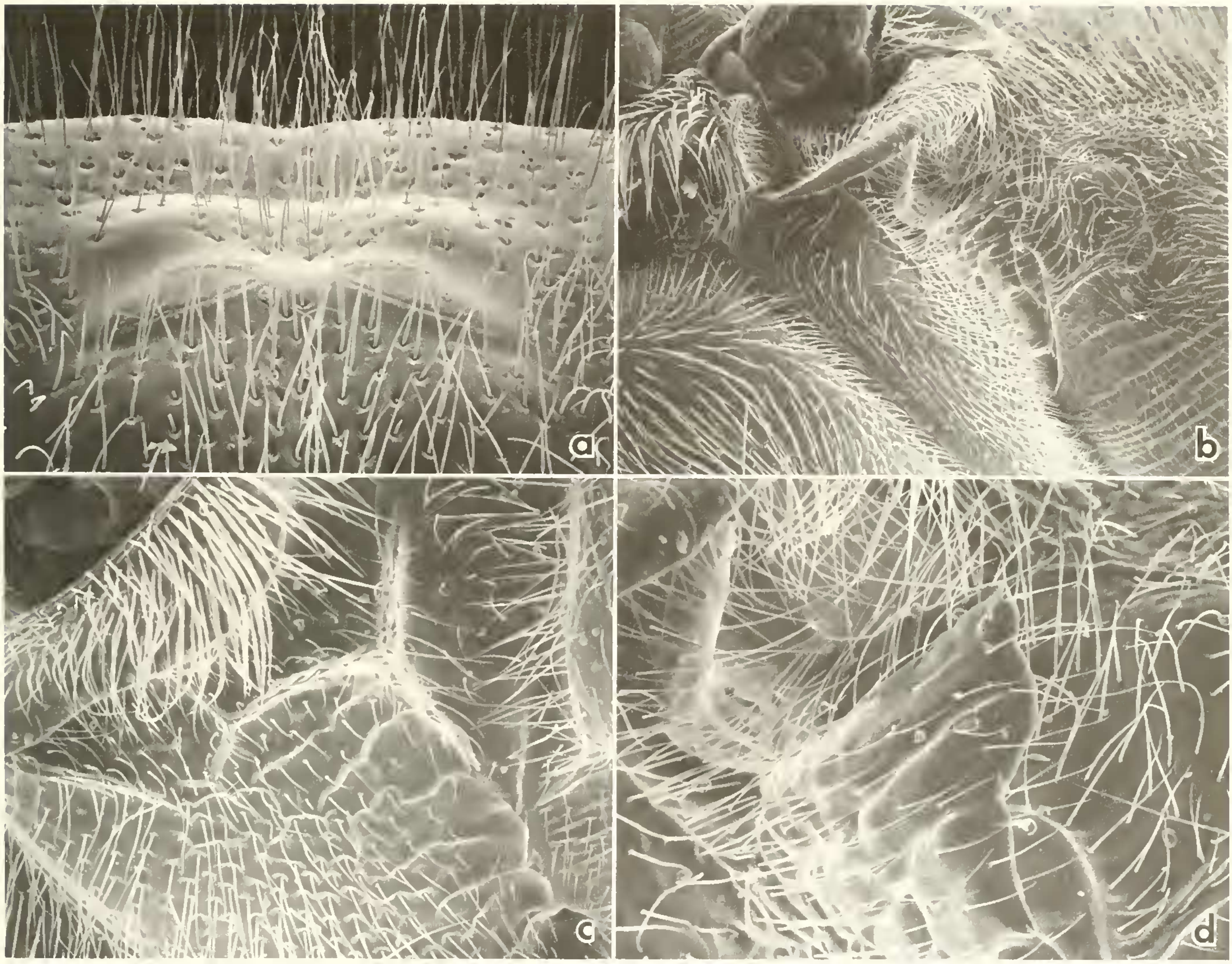

FIGURE 114. *Tachysphex terminatus* (F. Smith): a—hindocellar area of female; b—upper metapleuron, lateral view; c—same, top view; d—prespiracular prominence of upper metapleuron.

Vestiture totally obscuring sculpture between antennal socket and orbit (except in small males).

Gaster in most specimens with two or three apical segments red, but all black in several females from Ontario, and also in some females from New Jersey (Vineland, 1♀, CU; Westville, 1♀, ANSP) and New York (Broadalbin, 1♀, NYSU). Terga I–IV silvery fasciate apically. Wings hyaline to moderately infumate.

♀.—Clypeal lip arcuate, sometimes with obtuse, median projection. Dorsal length of flagellomere I 1.4–1.8 × apical width. Frons punctate to (some specimens) punctatorugose. Vertex width 2.0–2.2 × length. Length 6.5–10.0 mm.

Setal length about 2.0 MOD on vertex and anterolaterally on scutum.

♂.—Clypeal lip arcuate to almost straight, lateral corners sometimes prominent, usually closer to antennal socket than to each other (sometimes equidistant). Frons punctate, punctures subcontiguous. Vertex width 2.0–2.5 × length. Sterna III–IV glabrous, at least posteriorly. Foretarsal rake well developed; outer apical spine of foretarsomere II longer than tarsomere III. Length 5–8 mm.

Setal length about 1.7 MOD on vertex and about 2.0 MOD anterolaterally on scutum.

VARIATION.—The size of *terminatus* varies seasonally (Elliott and Kurczewski 1975): females of the first generation store more prey and a larger biomass, with the result that second generation females are slightly larger; the latter store less food, and consequently first generation females are slightly smaller. Elliott and Kurczewski (1974) also found size displacement in a mixed colony of *terminatus* and *similis* in Pottawatomie Co., Kansas. Individuals of *terminatus* averaged larger than in allopatric situations, individuals of *similis* averaged smaller.

The geographic variation of *terminatus* was analyzed by Elliott and Kurczewski (1978), but they actually confused two species: *alpestris* and *terminatus* (but see Remark under *alpestris*). I have seen the material.

LIFE HISTORY.—There are two generations per year in the northeastern United States (Elliott and Kurczewski 1974), emerging in June and August, whereas Strandtmann (1953) thinks that five generations per year are possible in Texas. The flight period in Texas is from May through October (Strandtmann

1953), but I examined a female from Bentsen Rio Grande Valley State Park, Texas (USNM) collected as late as 30 November–2 December). Krombein (1951) observed individuals feeding on tulip-tree honeydew produced by *Toumeyella liriodendri* (Gmel.), and also (1953*a*) on foliage of *Quercus marilandica* Muench., *Carya* sp., and *Pinus serotina* Michx. Robertson (1928) found *terminatus* on flowers of *Cicuta maculata* L. and *Sium suave* Walt. (=*cicutaefolium* Schrank). The species is gregarious: Kurczewski and Harris (1968) found 12 cells in each of two plots of about 0.5 m², Strandtmann (1953) found 10 cells in a square foot, and Kurczewski (1966*b*) noted about 50 males on a sandy area about 4.0 × 1.8 m.

Habits of *terminatus* have been extensively studied by Kurczewski (mainly in coauthorship, see citations above) and others. Females nest in flat or sloping sandy areas with sparse vegetation, and in harder soil or clay (Rau and Rau 1918; Rau 1926). Those digging in sand seldom abandon unfinished nests, but in clay they often dig several burrows in succession before completing a nest (Rau and Rau 1918). The nest may have one to five cells, usually two or three. It is a regular gallery when excavated in sand, but "in hard earth it has any shape and size that they can best excavate" (Rau and Rau 1918). The gallery is oblique to the soil surface. It is 6.2–10.8 cm long in sand, with its lower end 4.2–5.7 cm below the surface (3 cm according to Strandtmann 1953). However, nests dug in the loose dirt on the top of a clay bank (Rau 1926) were so shallow that they could be exposed by blowing. Normally, the nest entrance is temporarily closed during the provisioning period. However, the nest is sometimes established on steep slopes so that excavated sand rolls down and cannot be reused for temporary closure (Kurczewski and Snyder 1968). In such situations, the closure is incomplete. The nest may also remain open as the result of high temperatures: Miller and Kurczewski (1973) observed a female making only a token effort to close the nest before leaving, when the sand temperature was 62°C (at 49°C, the wasp simply entered the nest by digging away the sand; at 57°C she dug more rapidly, but four digging periods separated by three short hovering flights were necessary for the wasp to gain entry). Orientation flights are performed after completion of the nest (F. E. Kurczewski, pers. comm.). Prey consists of first- and second-instar Acrididae nymphs and rarely includes Tettigoniidae (see below for details). The mean length of 906 acridid prey from Groton, New York, is about 6.8 mm (Kurczewski 1966*a*; Evans 1970). Known acridid prey are listed below:

Prey	Source
Arphia sulphurea (Fabricius)	Rau 1946
Chloealtis conspersa (Harris)	Kurczewski 1966*a*
Chorthippus curtipennis (Harris)	Kurczewski 1966*a*
Chortophaga viridifasciata (DeGeer)	Ashmead 1894, Rau 1926
Dichromorpha viridis (Scudder)	Rau and Rau 1918, Rau 1946
Dissosteira carolina (Linnaeus)	Kurczewski 1966*a*
Melanoplus bivittatus (Say)	Kurczewski 1966*a*
Melanoplus femurrubrum (DeGeer)	Kurczewski 1966*a*
Melanoplus keeleri luridus (Dodge)	Kurczewski 1966*a*
Melanoplus sp.	Rau and Rau 1918, Rau 1946, Strandtmann 1953
Oedipodid nymphs	Rau and Rau 1953
Pardalophora apiculata (Harris)?	Kurczewski 1966*a*
Syrbula admirabilis (Uhler)	Rau and Rau 1918
Tryxaline nymph	Williams 1914

G. Bohart's (1951) record of Tetrigidae as prey of *terminatus* (repeated in Bohart and Menke 1976) is probably erroneous. I have been unable to confirm this. Strandtmann (1953) recorded *Tryxalis* sp., but the record cannot be accurate, because *Tryxalis* is not a New World genus (Finnamore 1982).

The grasshopper prey are flown to the nest, head forward and venter up. The prey's antennae are grasped by the mandibles of the wasp and her legs embrace the hopper's body. However, Strandtmann (1953, fig. 2) drew a nymph held venter down during transport. The prey is dropped on the ground venter up, while the wasp opens the nest. She then enters the burrow, turns around inside, emerges headfirst, and reenters backwards, pulling the prey inside by its antennae. One female provisioning the nest dug in a steep slope and incompletely closed, entered the nest without first dropping the grasshopper (Kurczewski and Snyder 1968).

The occasional use of tettigoniid instead of acridid prey at Groton, New York is especially interesting (Kurczewski 1966*a*). From 1960 to 1963 he examined 926 prey, all Acrididae. However, four small tettigoniid nymphs were collected by at least three wasps (possibly four) in June 1964. Kurczewski's prey were determined by A. B. Gurney as *Phaneroptera*, but as Finnamore (1982) points out, *Phaneroptera* is not a New World genus. At my request, David A. Nickle of the U.S. Department of Agriculture reexamined the specimens and found that they are a *Scudderia*, probably *furcata* Brunner von Wattenwyl. Only one acridid species, *Melanoplus bivittatus* (Say), was stored in the cell with *Scudderia*. A scarcity of grasshopper nymphs of suitable size may have been the reason for the wasp's unusual behavior. Another possible explanation is the abundance of tettigoniids. No abnormal behavior in prey transport and storage was observed, except that one *Scudderia* was abandoned at the nest entrance; the nest was subsequently filled with Acrididae. Each of the three other *Scudderia* was placed in a separate cell, together with two, five, and seven grasshoppers, respectively. No egg was laid on a tettigoniid, possibly because of their small size.

From three to nine prey are stored in a cell (Rau and Rau 1918; Kurczewski 1966*a*), their number being inversely proportional to their size (Strandtmann 1953). They are deposited head in, usually venter up, rarely dorsum up. The wasp's egg is laid across the prothoracic venter on one of the larger prey, usually the largest one. The larva consumes the provision in about a week, and the full developmental period from egg laying to adult emergence takes about two weeks in Texas (Strandtmann 1953).

Male behavior was studied by Kurczewski (1966*b*). The flight period begins and ends earlier in the season than the female's. The males fly rapidly but low over the ground, and land for short periods. As their number in an area increases, more of them appear to adhere rigidly to certain perches, such as stones, vegetation, pieces of wood and bark. Chasing or grappling occurs frequently (the resident usually pursues an intruder who has landed nearby). A male may perch motionless with raised forelegs, raised, rigid antennae, and the gastral tip touching (or nearly so) the sand surface. He may then pivot to the left or right, while keeping the gastral tip stationary. Open holes near their perches often attract his attention. Males spend the night, extremely hot periods, and inclement weather in shallow burrows that they dig with mandibles and forelegs. Unlike the female, the male does not level the tumulus that accumulates at the burrow entrance. The burrow is closed off from within and has no apical cell. He stays at the end of the burrow, his head toward the entrance.

Copulation takes place on the ground and lasts for 25–35 seconds (Kurczewski 1966*b*). The male mounts the female, his wings folded flat over the dorsum. Nesting females usually resist males' attempts to mate.

Phrosinella aurifacies Downes, *Senotainia trilineata* (van der Wulp), and *S. vigilans* Allen (Diptera: Sarcophagidae) are cleptoparasites of *terminatus* (Spofford et al. 1986). Females of *Phrosinella aurifacies* fly in search of wasp nests (they investigate disturbed sand) and larviposit in the nest's entrance. Females of *Senotainia trilineata* maintain surveillance perches and pursue wasps carrying prey in the air (occasionally making contact in midair) or on the ground, but pay no attention to unattended prey. Females of *Senotainia vigilans* are attracted to provisioning or digging wasps (they remain near the nest until the wasp returns with prey); they larviposit on the prey while the wasp opens or enters the nest, inside the burrow, or in the entrance. Wasps try to evade pursuing flies, chase them off, or abandon their prey; they also clean maggots off the prey. *Perilampus hyalinus* Say (Hymenoptera: Perilampidae) parasitizes (Spofford and Kurczewski 1984) the two *Senotainia* that develop on the prey of *terminatus*.

Geographic Distribution (Fig. 115).—Widespread in North America, but absent from southern Florida, and west of 110th meridian. The species ranges from southern Manitoba and Prince Edward Island to El Salvador, and there are records from northern Colombia and the Roraima Territory in Brazil. It is largely replaced by *alpestris* west of the Rocky Mountains.

Material Examined.—954♀, 763♂.

Records.—CANADA **Alberta:** Medicine Hat. **Manitoba:** Aweme, 5 mi W Carberry, 2 mi W Stockton. **Nova Scotia:** Halifax Co Cape Breton Highlands National Park, Lawrencetown. **Ontario:** Belleville, Brighton, Merivale near Ottawa, Ottawa, Point Pelee, Spencerville, Toronto. **Prince Edward Island:** Alberton, Brackley Beach, Dalvay House (P.E.I National Park). **Quebec:** Hull, Joliette, Kazabazua, Lakeside, Lanoraie, Saint Hilaire, Tadoussac

UNITED STATES. ALABAMA **Clarke:** Thomasville. **Montgomery:** Montgomery. ARIZONA. **Cochise. Mohave:** Bullhead, Wikieup. **Pima:** Box Canyon, Sabino Canyon, Sahuarita. **Santa Cruz:** Nogales (also 10 mi NW), Sycamore Canyon (31°25'N, 111°12'W). **Yavapai:** Dewey. ARKANSAS **Craighead:** Brookland. **Lafayette:** Lewisville. COLORADO: **Bent:** 2 mi S Hasty, 2 mi S Las Animas. **Boulder:** Boulder **Cheyenne:** Aroya **Crowley:** Ordway. **Larimer:** 14 mi N Fort Collins, Hewlett Gulch. **Logan:** Crook. **Mineral:** Creede. **Prowers:** Carlton. **Weld:** 1 mi NE Roggen. CONNECTICUT: **Hartford:** Hartford **Middlesex:** Old Saybrook. **New Haven:** Haven. DISTRICT OF COLUMBIA. Washington. FLORIDA **Alachua:** Gainesville (1♀, 6 June 1976, W H Pierce, UCD) **Gadsden:** Quincy. GEORGIA: **Chatham:** Savannah. **Clarke:** Athens, Whitehall Forest. **Decatur:** Bainbridge. **De Kalb:** Stone Mt **Fulton:** Atlanta, Silver Lake. **Richmond:** Fort Gordon. **Thomas:** Ochlocknee. ILLINOIS **Jackson:** Grand Tower. **Kane:** near Camp Big Timber. **Kankakee, Lake:** —. **Macoupin:** Carlinville. **McHenry:** Algonquin, McHenry **Mason:** Havana, Sand Ridge State Forest. **Morgan:** Meredosia. **Peoria:** Peoria **Williamson:** Crab Orchard Lake INDIANA. **Knox:** Vincennes. **Tippecanoe:** Lafayette. IOWA **Story:** Ames, 4 mi N Gilbert. **Woodbury:** Sargeant Bluff, Sioux City. KANSAS **Atchison, Barton, Clay, Graham, Meade, Ness, Osborne, Phillips, Russell, Smith:** — **Douglas:** Lawrence (also 5 mi NW). **Ford:** Dodge City **Hamilton:** 2.5 mi S Kendall. **Kearny:** Lakin (also 9–13 mi S). **Kiowa:** Belvidere. **Ottawa:** 5 mi N Bennington. **Pottawatomie:** Blackjack Creek, 6 mi W Wamego. **Reno:** Pretty Prairie. **Riley:** Manhattan. MAINE **Cumberland:** Portland. **Lincoln:** —. MARYLAND **Anne Arundel:** Odenton. **Calvert:** — **Prince Georges:** Beltsville, Laurel. MASSACHUSETTS **Barnstable. Essex:** Andover **Hampden:** Springfield. **Middlesex:** Bedford, Chelmsford, Lexington **Nantucket:** Nantucket Island. **Norfolk:** Needham. **Suffolk:** Boston. MICHIGAN **Alger:** —. **Berrien:** E K Warren State Park. **Clinton:** Rose Lake W. E S **Emmet:** Sturgeon Bay **Livingston:** E. S. George Reserve. **Marquette:** Huron Mountain Club, Muskegon State Park **Washtenaw:** Ann Arbor, Pinckney State Park on Half Moon Lake. **Wayne:** Detroit, Palmer Point. **Crawford, Kalkaska, Mecosta, Oakland:** —. MINNESOTA **Anoka:** Fridley Sand Dunes. **Blue Earth:** Mankato **Houston:** La Crescent **Koochiching:** — **Lesueur:** Blakeley. **Nicolett:** Courtland. **Ramsey:** —. **Renville:** Olivia **Sherburne:** —. MISSISSIPPI **Monroe:** Aberdeen. MISSOURI: **Boone:** Columbia **St. Louis City:** St. Louis. MONTANA **Dawson:** Glendive. NEBRASKA. **Cuming:** West Point **Dawson:** Cozad. **Douglas:** Omaha. **Fillmore:** Fairmont. **Hooker:** 1.5 mi N Mullen **Kearney:** Kearney. **Morrill:** Bridgeport. **Sioux:** Glen. **Thomas:** Halsey, Thedford. NEW HAMPSHIRE: **Belknap:** Gilford–Alton. **Grafton:** Franconia, Hanover, White Mts. **Rockingham:** Hampton, Wentworth near New Castle NEW JERSEY **Atlantic:** Weymouth. **Burlington:** Browns Mills, Chatsworth, Lebanon State Forest **Camden:** Clementon. **Cape May:** Reeds Beach, Stone Harbor **Cumberland:** Vineland. **Gloucester:** Glassboro, North Woodbury, Westville. **Monmouth:** Freehold, Ocean Township, Tinton Falls **Ocean:** Lakehurst Lakewood. NEW MEXICO **Bernalillo:** Albuquerque **Grant:** —. **De Baca:** Sumner Lake State Park **Guadalupe:** Santa Rosa. **Hidalgo:** 15 mi S Animas, Rodeo **Lincoln:** Devils Canyon (20 mi NE Ruidoso) **Luna:** Deming. **Quay:** Tucumcari, Ute Lake State Park. **Socorro:** 4 mi W Abo State Monument, La Joya (20 mi N Socorro). **Roosevelt:** Oasis State Park, Portales. NEW YORK: **Albany:** Albany, Colonie, 2 mi S Rensselaerville. **Cayuga:** Auburn, Fair Haven, Union Springs. **Fulton:** Broadalbin **Madison:** Chittenango, Hamilton. **Monroe:** Rochester **New York City:** Pelham Park **Oswego. Otsego:** East Worcester. **Putnam:** Brewster **Richmond:** Staten Island. **Rockland:** Nyack **Suffolk. Sullivan:** Beaver Kill. **Tompkins:** Groton, Ithaca, Ringwood. **Wayne:** —. NORTH CAROLINA **Brunswick:** Long Beach. **Dare:** Kill Devil Hills, Nags Head. **Macon:** Highlands. **Moore:** Southern Pines. **New Hanover:** Carolina Beach. **Onslow:** Onslow Beach. **Pender:** Surf City **Wake:** Raleigh. NORTH DAKOTA **Golden Valley:** Beach **Ransom:** Sheldon (also 7 mi NE) **Richland:** 11 and 13 mi W Walcott. OHIO. **Franklin:** Columbus OKLAHOMA: **Beaver:** Beaver State Park. **Cimarron:** Black Mesa State Park **Marshall:** Lake Texoma (2 mi E Willis). **Tulsa:** Tulsa. PENNSYLVANIA **Alleghany:** Natrona. **Erie:** Presque Isle State Park. **Huntingdon:** Turkey Run State Park **Lehigh:** Lehigh Gap. **Philadelphia:** Philadelphia. **Westmoreland:** Jeannette. SOUTH CAROLINA **Allendale:** Fairfax. **Georgetown:** 6 mi SSW Murrells Inlet. **Horry:** Myrtle Beach. TENNESSEE **Knox:** —. **Shelby:** Memphis. TEXAS. **Atascosa:** Lytle **Austin:** St. Austin State Park near Sealy. **Bexar:** — **Bosque:** Valley Mills **Brazos:** College Station **Brewster:** Rio Grande. **Brooks:** 8 mi E Encino. **Comal:** New Braunfels **Dallam:** Conlen **Galveston:** Galveston. **Hidalgo:** Bentsen Rio Grande Valley State Park, McAllen Botanical Garden. **Jim Wells:** Palito Blanco. **Kenedy:** 3 mi S Sarita, Risken Ranch (27°10'N, 97°40'W). **Kimble:** Junction. **Kleberg:** Kingsville, Baffin Bay 20 mi SE Kingsville. **Lee:** Fedor. **Llano:** 11 mi E Llano. **Newton:** Sabina River at Highway 190 **Potter:** 5 mi N Amarillo **Randall:** Palo Duro Canyon **Refugio:** Bayside. **San Patricio:** Aransas River 10 mi NE Sinton, Chiltipin Creek at routes 77 and 181, Welder Wildlife Refuge (7 mi NE Sinton) **Starr:** Rio Grande City **Travis:** Austin. **Uvalde:** Nueces River **Webb:** 23 mi W Freer. **Wharton:** Wharton. **Wilson:** Floresville VERMONT **Orange:** Strafford, Union Village. VIRGINIA **Alleghany:** Clifton Forge. **Arlington:** Arlington, Glencarlyn **Fairfax. Loudoun:** — **Montgomery:** Westmoreland. **Norfolk:** Dismal Swamp **Westmoreland:** Westmoreland State Park WISCONSIN **Chippewa:** Stanley **Dane:** Madison **Grant:** Rutledge **Milwaukee:** Milwaukee **Pierce:** Maiden Rock, Prescott **St. Croix:** N of Hudson **Vernon:** Genoa

MEXICO **Chiapas:** Montebello National Park **Chihuahua:** 35 mi N Chihuahua, 11 mi W Gran Morelos, Hidalgo del Parral (also 9 mi S), 10 mi N Jimenez, 2 km W San Pablo Balleza (which is 26°57'N, 106°21'W) **Durango:** 10 mi W Durango, Nombre de Dios (23°51'N, 104°14'W). **Guanajuato:** 10 mi N Silao. **Jalisco:** Atenguillo (65 km SSW Ameca), Estanzuela (40 km W Ameca), Guadalajara, Plan de Barrancas. **Mexico:** Tepexpan **Michoacan:** Ciudad Hidalgo. **Morelos:** Yautepec **Nayarit:** Playa Matanchen near San Blas **Oaxaca:** 10 mi SE Tepanatepec **San Luis Potosi:** El Naranjo–El Salto **Sinaloa:** 2.5 mi N Mazatlan, 20 mi E Villa Unión. **Sonora:** Magdalena, Rio Chuchajachi (7 mi S Alamos), E Yaqui River (35 air km WSW Sahuaripa), 15–25 km NW Yecora. **Tamaulipas:** Matamoros, Municipio de Aldama (Rancho Nuevo), Rio Blanco (18 mi N Ciudad Victoria) **Tlaxcala:** 10 mi N Apizaco **Veracruz:** Fortin de las Flores **Zacatecas:** 2 km SW Valparaiso

CENTRAL AND SOUTH AMERICA (some South American records are not shown on Fig. 115): BRAZIL **Roraima Territory:** Surumu COLOMBIA **Guajira:** Riohacha **Valle del Cauca:** Cali. **Tolima:** Armero. EL SALVADOR Quezaltepeque GUATEMALA near Guatemala, Lago de Atitlán VENEZUELA **Valle:** Loboguerrera. **Zulia:** Rosario

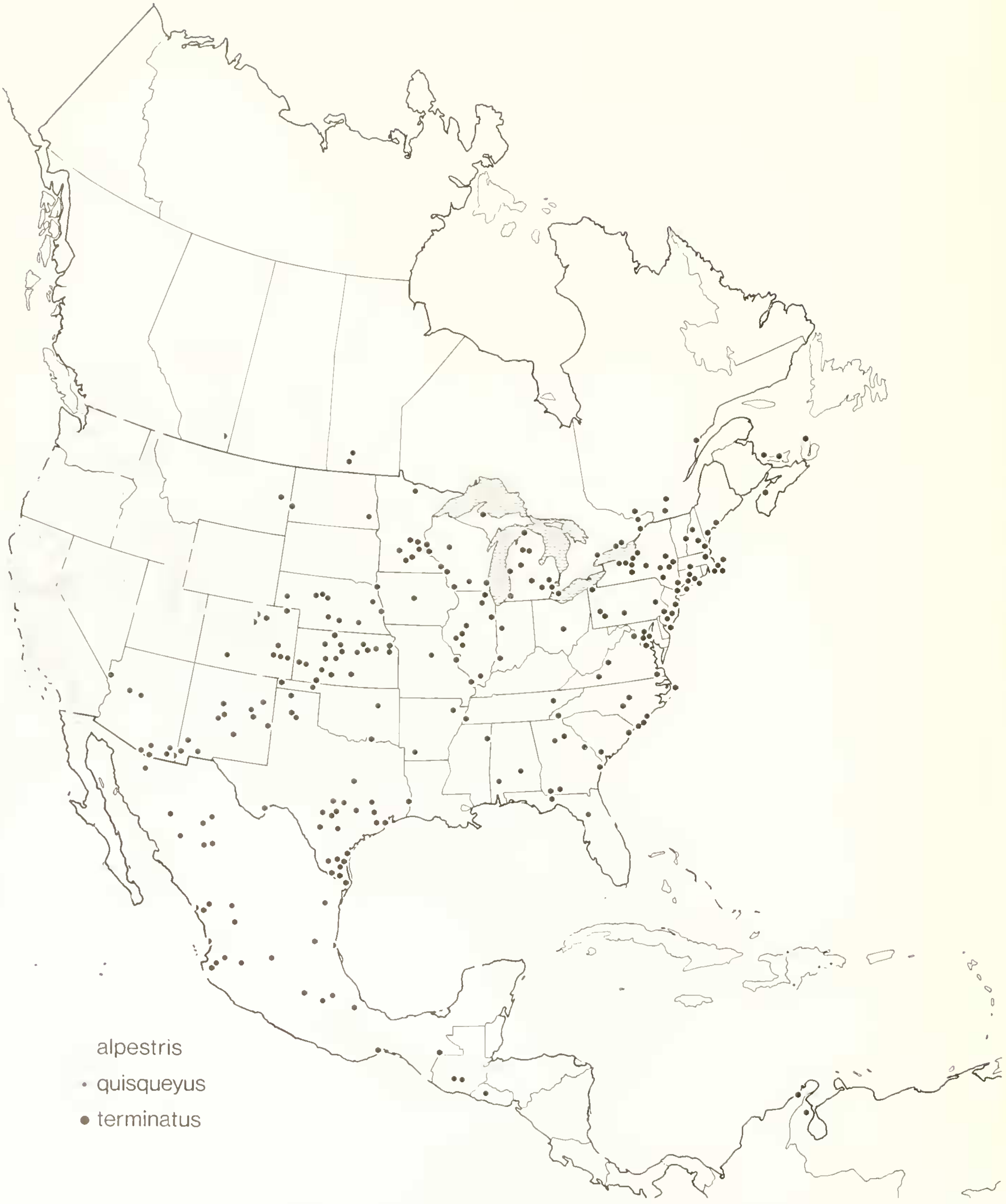

FIGURE 115. Geographic distribution of *Tachysphex alpestris* Rohwer, *quisqueyus* sp. n., and *terminatus* (F. Smith).

Tachysphex similis Rohwer

(Figures 115, 117)

Tachysphex similis Rohwer, 1910:51, ♀, ♂. ! Lectotype: ♀, Texas: Lee Co.: Fedor (USNM), present designation.—J. Smith 1910:683. Krombein 1950:267; Wray 1950:38; G. Bohart 1951:952; Krombein 1951:143, 1952:93, 1953*a*:330, 1953*b*: 122, 132; Krombein and Evans 1954:232, 1955:231; Krombein 1958*c*:188, 1963*b*:273, 1964:15; Kurczewski 1966*b*:436–453, Krombein 1967:393, Kurczewski 1967:279, 1971:114 (in key); Wray 1967:123; Elliott and Kurczewski 1974:725; Bohart and Menke 1976:276; Krombein 1979:1631; Finnamore 1982: 104. Elliott and Kurczewski 1985:295

Tachysphex similans Rohwer, 1910:52, ♀. ! Holotype: ♀, Texas: Lee Co.: Fedor (USNM). Synonymized by G. Bohart 1951:952.

Tachysphex terminatus Krombein 1953*c*:13 (!).

DIAGNOSIS.—*Tachysphex similis* has a toothlike prespiracular prominence on the upper metapleuron (Fig. 116b–d), the posterior margin of the prominence being approximately as long as the anterior one. In most specimens, the prominence is sharper than in other species (*apicalis, terminatus*) that have a similar structure. The female can also be recognized by an unevenly microrugose frons with ill-defined punctures (Fig. 116a) combined with a narrow vertex (width 1.4–1.7 × length). The male differs from *apicalis* in having a well-developed foretarsal rake, and from *terminatus* by the characters discussed under that species.

DESCRIPTION.—Frons unevenly microrugose, with ill-defined punctures (Fig. 116a) that are totally reduced in some specimens. Scutal punctures, in most specimens, less than one diameter apart adjacent to margins and around admedian lines, but one to three diameters apart in remaining U-shaped area; all punctures about one diameter apart or less in many individuals. Upper metapleuron (Fig. 116b–d): flange broad, oblique carina beneath its anterior end becoming higher toward flange but abruptly lowered at its attachment; prespiracular prominence conspicuous, consisting of three carinae (anterior, posterior, and admedian one) which have a common apex; anterior and posterior carinae about equal in length; prominence acutely angulate in most females and many males. Propodeum finely sculptured between dorsum and side. Basal tooth of hindcoxa large in most specimens.

Vestiture partly obscuring sculpture between antennal socket and orbit.

♀.—Width of clypeus 2.4–2.8 × length; bevel shorter than basal area; lip arcuate, without median projection. Vertex width 1.4–1.7 × length. Dorsal length of flagellomere I 1.5–1.9 × apical width. Length 6.0–9.5 mm.

Setal length about 1.7 MOD on vertex and about 1.0 MOD on scutum anterolaterally.

Gaster usually black, but occasionally one or two apical segments yellowish red (specimens with red gastral tip are frequent in Lawrence and Manhattan, Kansas; Kenedy, Kleberg, and Lee counties, Texas; and in Nebraska). Terga I–IV silvery fasciate apically.

♂.—Width of clypeus 2.2–2.7 × length; lip corners equidistant from antennal socket and one another. Vertex width 1.6–2.2 × length. Outer apical spine of foretarsomere II sometimes only two-thirds length of tarsomere III, but even then distinctly longer than corresponding inner spine. Length 4.4–6.2 mm.

Setal length about 1.3 MOD on vertex and 1.0 MOD on scutum anterolaterally.

Gaster usually black, but segment VII red in some specimens from Kansas and Fedor, Texas, and also in occasional specimens from Florida and New Jersey. Gastral terga I–IV or I–V silvery fasciate apically.

VARIATION.—The mesopleural punctures are about one diameter apart in most specimens. They average two diameters apart in two females from Eleuthera Island, Bahamas (AMNH, FSCA), but are the usual distance apart in the seven males from that island (CAS, FSCA).

Elliott and Kurczewski (1974) found size displacement in mixed colonies of *similis* and *terminatus*. See the latter species for details.

LIFE HISTORY.—Krombein (1951) observed individuals feeding on tulip-tree honeydew produced by *Toumeyella liriodendri* (Gmel.), and also (1953*a*) visiting foliage of *Quercus marilandica* Muench. When digging a nest, the female works with both forelegs moving synchronously (Krombein 1964). She levels the sand that accumulates at the nest entrance. The nest may be 7.5 cm long, with the lower end 3–6 cm below the soil surface (the burrow is oblique to the soil surface). Krombein recorded two or three cells per nest, but Elliott and Kurczewski (1985) observed one and four. The burrow is temporarily closed during the provisioning period. The known prey consists of young grasshopper nymphs of *Radinotatum* sp. (Krombein and Evans 1955), *Aptenopedes* sp., and *Melanoplus* sp. (Krombein 1964), and also *Melanoplus* sp., *Mermeria* sp., *Opeia obscura* (Thomas), and *Pseudopomala brachyptera* (Scudder) according to Elliott and Kurczewski (1985). Two females studied are pinned with prey: one from Marco, Florida (AMNH), with a juvenile *Schistocerca* sp., det. A. B. Gurney, and one from St. Catherine Island, Georgia (UGA) with a nymph of *Melanoplus devastator* Scudder, det. D. C. F. Rentz. The prey may be flown or transported on the ground. It is held venter up, the wasp's mandibles grasping the antennal bases. Prey is deposited about 1 cm from the nest entrance; the female then opens the temporary closure, enters the nest, turns around inside, emerges headfirst, grasps the grasshopper, and pulls it inside. From 4 to 10 prey, 5–8 mm long, may be stored in a cell (Krombein 1964), but Elliott and Kurczewski (1985) observed 3 and 5 prey per cell. The only egg observed was laid across the venter of the largest prey between the fore- and midcoxae.

The male behavior (Kurczewski 1966*b*) is as described for *terminatus* (see that species), with a few minor differences.

GEOGRAPHIC DISTRIBUTION (Fig. 117).—United States and Canada east of the Rocky Mountains (also Colorado, Utah, and southern Alberta), north to New Brunswick and Northwest Territories; and south to Minatitlán, Mexico; also Bahama Islands.

MATERIAL EXAMINED.—1,092♀, 532♂.

RECORDS.—CANADA: **Alberta:** Medicine Hat, 12 km SW Orion, Writing-on-Stone Provincial Park. **Manitoba:** Aweme, Brandon, 5 mi W Carberry, 2 mi W Stockton. **New Brunswick:** Shediac. **Northwest Territories:** Rae. **Ontario:** Belleville, Fort Erie, Kearney, Ontario, Strathroy, Toronto. **Quebec:** Kazabazua, Lakeside, Lanoraie, St. Hilaire. **Saskatchewan:** Elbow, Moose Jaw (also 21 mi W).

UNITED STATES. ALABAMA: **Limestone:** Decatur. **Montgomery:** Montgomery. ARKANSAS: **Desha, Madison:** —. COLORADO: **Bent:** Hasty. **Boulder:** White Rocks near Boulder. **Costilla:** Ute Creek. **El Paso:** Colorado Springs. **Larimer:** Fort Collins. **Moffat:** Lay. **Morgan:** —. **Weld:** Owl Creek (11 mi NE Nunn). CONNECTICUT: **Tolland:** Vernon. DISTRICT OF COLUMBIA: Washington. FLORIDA: **Alachua. Brevard:** Cocoa, Titusville. **Broward:** Lauderdale, Seminole State Park. **Calhoun:** Blountstown. **Charlotte:** Bermont, Punta Gorda. **Clay:** Camp Crystal. **Collier:** Corkscrew Swamp Sanctuary, Everglades, Marco. **Dade:** Miami. **DeSoto:** Arcadia. **Duval:** Jacksonville, Millerton. **Gadsden:** Quincy. **Glades:** Palm-

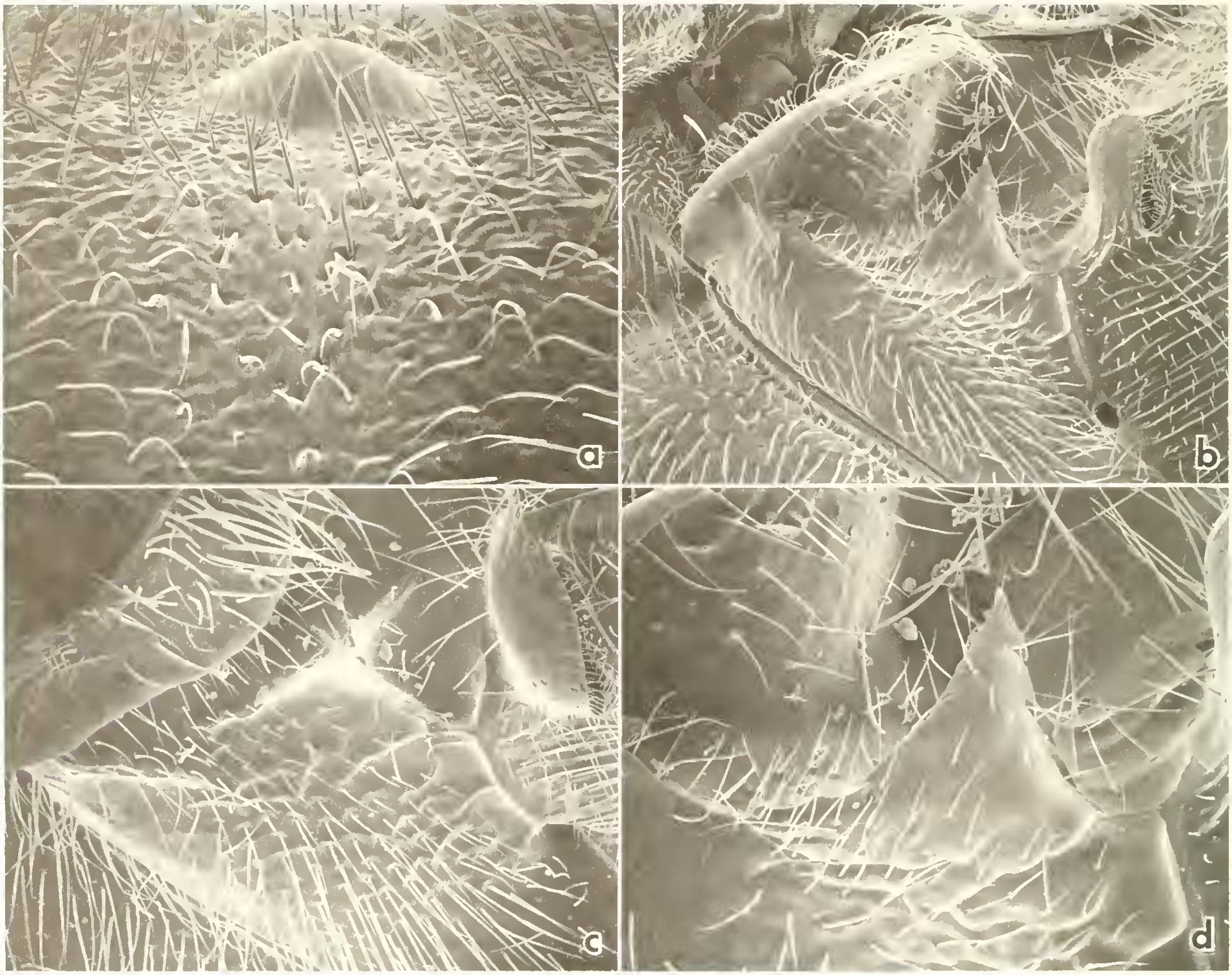

FIGURE 116. *Tachysphex similis* Rohwer, female: a—frons adjacent to midocellus, b—upper metapleuron, lateral view, c—same, top view, d—prespiracular prominence of upper metapleuron

dale. **Gulf:** St. Joseph Peninsula. **Hendry:** LaBelle. **Highlands. Lake:** Leesburg. **Lee:** Olga, Fort Myers, Sannibel Island. **Leon:** Tall Timber Research Station. **Levy:** Cedar Key. **Liberty:** Apalachicola National Forest, Sumatra, Torreya State Park. **Manatee:** Bradetown. **Marion:** Eureka, Lake Eaton, 5 mi E Lynn. **Monroe:** Cape Sable, Key West. **Okaloosa:** 1.7 mi N Holt. **Orange:** Orlando, Vineland. **Pinellas:** Dunedin. **Polk:** Indian Lake Estates. **Putnam. Santa Rosa:** Blackwater River State Forest. **Sarasota:** —. **Suwannee:** Suwannee River State Park. **St. Lucie:** Fort Pierce. **Taylor:** Blue Spring Lake, Keaton Beach, 32 mi SE Perry. **Volusia:** Ormond Beach. **Wakulla:** Ochlockonee River State Park, 3 mi NW Sopchoppy. **Walton:** 2 mi E Mossy Head. GEORGIA. **Camden:** Cumberland Island. **Charlton:** Okefenoke Swamp. **Clarke:** Athens. **Decatur:** Springs Creek. **De Kalb.** Stone Mt. **Fulton:** Atlanta. **Glynn:** St. Simons Island. **Johnson:** near Kite. **Liberty:** St. Catherine's Island. **Marion:** Buena Vista. **Pike:** Zebulon. **Taylor:** Butler. **Tift:** Tifton. **White:** Cleveland. ILLINOIS. **Kankakee:** St. Anne. **Macoupin:** Carlinville. **Mason:** Havana Sand Ridge State Forest. **Morgan:** Meredosia. IOWA. **Story:** Ames. **Woodbury:** Sioux City. KANSAS. **Barton:** —. **Dickinson:** Abilene. **Douglas:** Baldwin, Lawrence (also 5 mi NW). **Osborne, Phillips:** —. **Pottawatomie:** Blackjack Creek, Little Gobi Desert. **Reno:** Medora. **Riley:** Manhattan. **Stafford:** Salt Flats area. KENTUCKY. **Hardin:** Fort Knox. LOUISIANA. **East Feliciana:** 4 mi S Jackson. MAINE. **Penobscot:** Orono. MARYLAND. **Ann Arundel:** Odenton. **Montgomery:** Plummers Island. **Prince Georges:** Beltsville. MASSACHUSETTS. **Barnstable:** Woods Hole. **Hampden.** Springfield. **Middlesex.** MICHIGAN. **Alger:** Pictured Rocks National Lakeshore. **Allegan:** Allegan State Game Area. **Cheboygan:** Douglas Lake. **Emmet:** Douglas Lake. **Huron:** Sand Point. **Livingston:** E. S. George Reserve. **Marquette:** Huron Mountain Club. **St. Joseph:** Klinger Lake. **Washtenaw:** Ann Arbor, Pinckney State Recreation Area near Half Moon Lake. **Wayne:** Palmer Peak. **Cheboygan, Iosco, Otsego, Van Buren:** —. MINNESOTA. **Hennepin:** Minneapolis. **Kittson:** Lancaster. **Nicolett:** Courtland. **Olmsted:** —. MISSISSIPPI. **Harrison:** 10 mi N Biloxi. **Marshall:** Holly Springs. MISSOURI. **Boone:** Columbia. **Warren:** Warrenton. MONTANA. **Dawson:** Glendive. **Jefferson:** —. NEBRASKA. **Antelope:** Grove Lake. **Cherry:** 10 mi S Nenzel (on Niobrara River), Valentine National Wildlife Refuge. **Cuming:** West Point. **Dawes:** Chadron. **Hooker:** 1.5 mi N Mullen, 15 mi S Mullen (on Dismal River). **Lincoln:** North Platte. **Scotts Bluff:** Mitchell. **Sioux:** Sawbelly Canyon. **Thomas:** Halsey, Thedford. NEW HAMPSHIRE. **Belknap:** Meredith. **Grafton:** Compton. **Strafford:** Durham. NEW JERSEY. **Atlantic:** Weymouth. **Bergen:** Ramsey. **Burlington:** Lebanon State Forest, Vincentown. **Camden:** Hadden Heights. **Cape May:** 3 mi S Seaville. **Cumberland:** Vineland. **Gloucester:** North Woodbury, Pitman. **Monmouth:** Little Silver. **Ocean:** Lakehurst, 5 mi W Lakewood, Point Pleasant. **Union:** Westfield. NEW MEXICO: **Bernalillo:** Albuquerque. **Sandoval:** Jemez Springs. **Socorro:** La Joya (20 mi N Socorro). NEW YORK. **Cayuga:** Fair Haven. **Monroe:** Rochester. **Suffolk:** Cold Spring Harbor, Mattituck. **Westchester:** Ardsley. NORTH CAROLINA. **Cumberland:** Fort Bragg. **Dare:** Kill Devil Hills, Nags Head. **Moore:** Southern Pines. **Pamlico:** Havelock. **Wake:** Raleigh. NORTH DAKOTA. **Golden Valley:** Beach. **Ransom:** Sheldon. **Richland:** McLeod area, Walcott, 13 mi W Walcott. OHIO. **Mercer:** —. OKLAHOMA. **Beaver:** Beaver State Park. **Cimarron:** Black Mesa

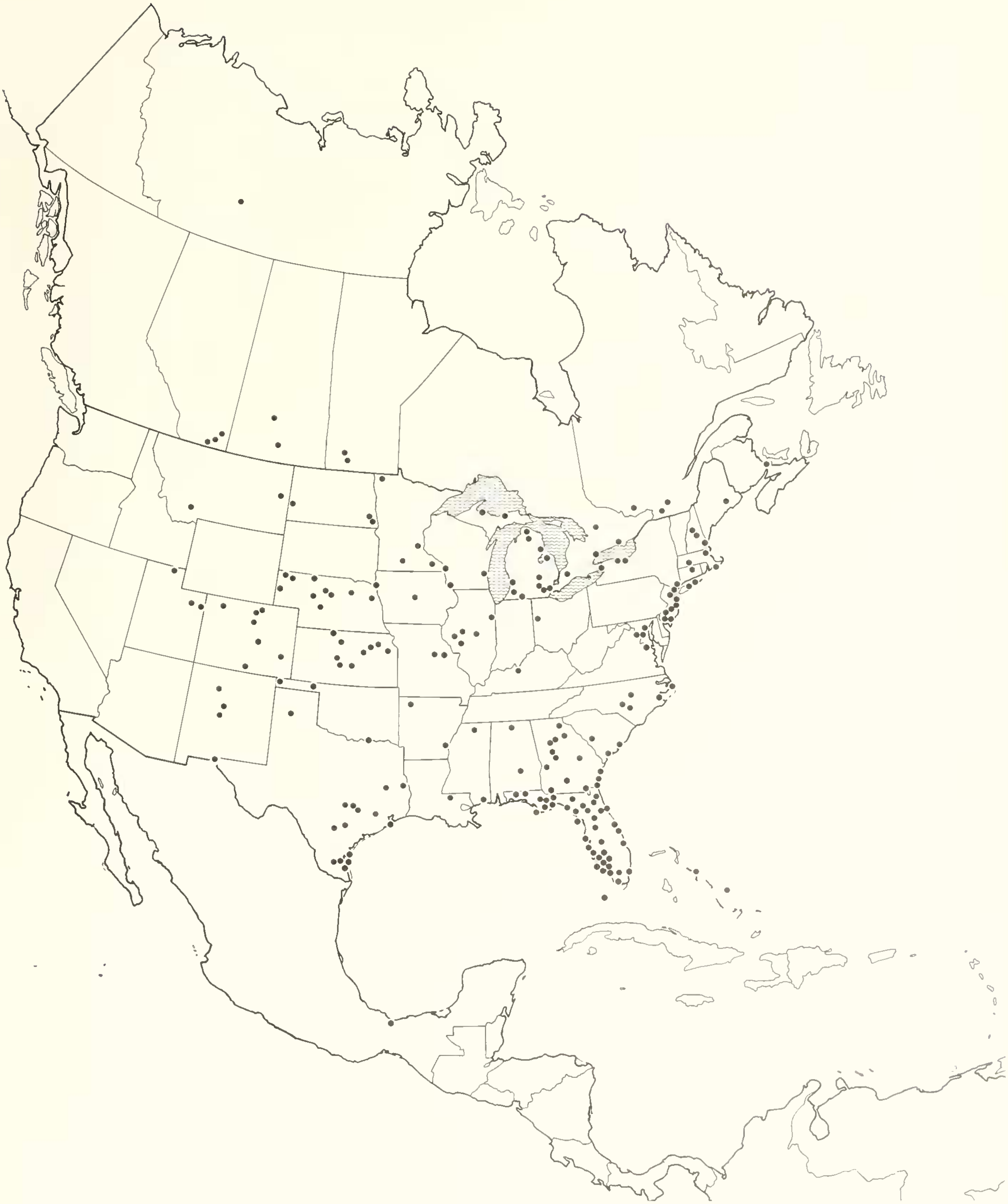

FIGURE 117. Geographic distribution of *Tachysphex similis* Rohwer.

State Park. **Marshall:** Lake Texoma (2 mi E Willis). SOUTH CAROLINA. **Aiken:** Aiken. **Beaufort:** Hilton Head Island. **Charleston:** Dewees Island. TEXAS. **Anderson:** Salmon. **Atascosa:** Pleasonton. **Bastrop:** 6 mi E Bastrop. **Bell:** Holland. **Caldwell:** Luling. **Duval:** 8 mi W Premont. **El Paso:** El Paso. **Galveston:** Galveston. **Gonzales:** Palmetto State Park. **Karnes:** Gillett. **Kenedy:** Risken Ranch (27°10′N, 97°40′E), Sarita. **Kleberg:** Kingsville, 6 mi E Riviera (=Baffin Bay 20 mi SE Kingsville). **Lee:** Fedor. **Nueces:** Padre Island. **Potter:** 5 mi N Amarillo. **Randall:** Palo Duro Canyon State Park. **Sabine:** 6 mi NW Hemphill. **San Patrizio:** 10 mi NE Sinton on Aransas River. **Waller:** Stephen Austin State Park near Sealy. UTAH. **Cache:** Cornish. **Duchesne:** Roosevelt. **Uintah:** SW Bonanza, Green River 5 mi NE Jensen. VIRGINIA. **Arlington:** Arlington. **Fairfax:** Dunn Loring near Vienna, Falls Church, Great Falls. **Westmoreland:** Westmoreland State Park. WISCONSIN. **Grant:** Rutledge, Wyalusing. **Vernon:** Genoa. **Washington:** West Bend.

MEXICO: **Veracruz:** Minatitlán.

BAHAMA ISLANDS. **Eleuthera Island:** Government Harbor's, Rainbow Bay. **San Salvador Island:** —.

Tachysphex apicalis W. Fox

(Figures 118, 119)

Tachysphex apicalis W. Fox, 1893:53, ♀, ♂. ! Lectotype: ♀, southern Florida: no specific locality (ANSP), designated by Cresson 1928:43.—W. Fox 1894*a*:521, Dalla Torre 1897:678, Ashmead 1899:250, Rohwer 1916:687; Britton 1920: 340; Brimley 1938:443, G. Bohart 1951:950; Krombein and Evans 1954:232, 1955:321, Evans 1964:288, Krombein 1964:15, Kurczewski 1966*b*:436; Krombein 1967:392, Kurczewski and Snyder 1968:30, 31, Kurczewski 1971:114 (in key), Pulawski 1974*a*:48, Bohart and Menke 1976:272, Rust et al. 1985:46; Parks 1986:34.—As *apicalis apicalis*: Pulawski *in* Krombein 1979:1630.

Tachysphex fumipennis W. Fox, 1894*a*:518, ♀. ! Lectotype: ♀, Florida: St. John's Co.: near St. Augustine (ANSP), designated by Cresson 1928:44. Synonymized by G. Bohart 1951:950.—Dalla Torre 1897:680, Ashmead 1899:250 (as *fuscipennis*).

Tachysphex fusus W. Fox, 1894*a*:519, ♀, ♂. ! Lectotype: ♀, Texas: no specific locality (ANSP), designated by Cresson 1928:44.—Dalla Torre 1897:680, Ashmead 1899:250, Cockerell 1900:144, Williams 1914:172, 201, Rohwer 1916:687 (as *fuscus*), Stevens 1917:422, Mickel 1918:422, Rau and Rau 1918:149 (as *fuscus*), Williams 1931:239, 1932:17, Brimley 1938:443, Williams 1940:367, Fullaway and Krauss 1945:36 (as *fuscus*); Strickland 1947:129 (as *fuscus*); G. Bohart 1951:951, Yoshimoto 1960:331 (as *fuscus*), Krombein 1967:393, Kurczewski and Snyder 1968:30, 31, Bohart and Menke 1976:274.—As *apicalis fusus*: Pulawski *in* Krombein 1979:1630, Rust et al. 1983:406, Elliott and Kurczewski 1985: 294.

Tachysphex foxii Rohwer, 1908:222, ♀. ! Holotype: ♀, Colorado: Boulder Co.: Boulder (USNM). Synonymized with *fusus* by G. Bohart 1951:951.

Diagnosis.—The following combination of characters distinguishes *apicalis*: clypeus narrow, its width 2.0–2.5 × length (Fig. 118a, b, f); frons shiny, frontal punctures in most specimens well defined (Fig. 118c); upper metapleuron with an angulate prespiracular prominence. The female clypeal lip has a small, median projection (Fig. 118b), also found in *antillarum*, *ruficaudis*, and some *terminatus*. The foretarsal rake is absent in most males (as it is in *ruficaudis*, some *linsleyi*, and the extralimital *galapagensis*). A rudimentary or fully developed rake is present in some males from the southeastern United States, but in specimens from this area (both sexes) the propodeum is coarsely sculptured between dorsum and side (Fig. 118e). This type of sculpture is shared with many *ruficaudis*.

Description.—Frons shiny, with well-defined punctures (Fig. 118c) except in occasional western specimens. Scutal punctures less than one diameter apart adjacent to margins and around admedian lines, but two or three to several diameters apart in remaining U-shaped area. Metapleural flange broad; upper metapleuron with prominence before propodeal spiracle (which is very small in some specimens from Nevada and California); prominence consisting of three carinae (anterior, posterior, and admedian) which have a common apex; anterior and posterior carinae about equal in length; oblique carina beneath anterior end of flange becoming higher toward flange, but abruptly lowered at its attachment. Hindcoxa with prominent basal tooth.

Sculpture not obscured or only partly obscured by vestiture between antennal socket and orbit.

♀.—Clypeus width 2.0–2.5 × length (Fig. 118a, b). Vertex width 1.8–2.3 × length. Setal length about 2.0 MOD on vertex, varying geographically on scutum.

♂.—Clypeus 2.1–2.3 × wider than long; lip arcuate, its corners obtuse to rectangular, slightly closer to each other than to antennal socket (Fig. 118f). Vertex width 2.1–2.6 × length. Sterna II–IV glabrous posteriorly. Setal length about 2.0–2.3 MOD on vertex, about 2.0 MOD on scutum.

Geographic Variation.—Over its range, *apicalis* has several forms which differ mainly in the propodeal sculpture and color of wings. These forms intergrade as given below:

1) The commonest and widespread form occurs throughout North and Central America but is absent from southeastern United States. It is characterized by a fine sculpture between the propodeal dorsum and side (Fig. 118d), and by the hyaline to weakly infumate wings. Setae about 2.0 MOD long anterolaterally on scutum. Female features are: clypeus 2.2–2.5 × wider than long; lip with one or three weak, obtuse projections; dorsal length of flagellomere I 2.0–2.4 × apical width; vertex width sometimes clearly more than twice length; length 7.0–9.5 mm; gaster with one or two apical segments red; terga I–IV (rarely I–V) silvery fasciate apically. Male features are: foretarsal rake absent; outer apical spine of foretarsomere II about as long as corresponding inner spine; length 5–8 mm; terga I–IV silvery fasciate apically.

2) Specimens from the southeastern United States (Washington, D.C., south to Florida) differ as follows: the propodeum is coarsely sculptured between the dorsum and side (Fig. 118e), and the wings, especially in the female, are infumate. Female features are: clypeus 2.0–2.3 × wider than long; lip with small, obtuse, median projection; dorsal length of flagellomere I 1.9–2.0 × apical width; length 8–10 mm; setal length 1.0 MOD (Florida) to 2.0 MOD (Washington, D.C.) anterolaterally on scutum; gaster black, segment VI usually red; terga I–III (Florida) or I–IV (Washington, D.C.) silvery fasciate apically. Male features are: foretarsal rake absent or rudimentary, but well developed in a male from Indian Lake Estate, Florida (UGA), in which there are five preapical rakes, and four of them are longer than basitarsal width; outer apical spine of foretarsomere II equal to or longer than corresponding inner spine; length 6.5–8.0 mm; setae length varying from about 1.0 to about 2.0 MOD anterolaterally on scutum; gaster black, two apical segments often reddish; terga I–III or I–IV silvery fasciate apically.

This is the nominotypical form of *Tachysphex apicalis* W. Fox.

3) Specimens from Nerinx, Kentucky (1♀, 3♂, USNM), and Santuc, South Carolina (1♀, UCD), display propodeal sculpture that is intermediate between forms 1 and 2, and their wings are weakly infumate. In the following females the propodeal sculpture is weak (as in the main continental form), but the wings are almost as dark as in the southeastern United States: one from Greenville, South Carolina (HKT), one from Kennesaw Mt., Georgia (UGA), and one from Warren Dunes State Park, Michigan (MOB). Specimens from the following localities are intermediate both in sculpture and wing color: Lehigh Gap, Pennsylvania (2♀, ANSP); North Woodbury, New Jersey (1♀,

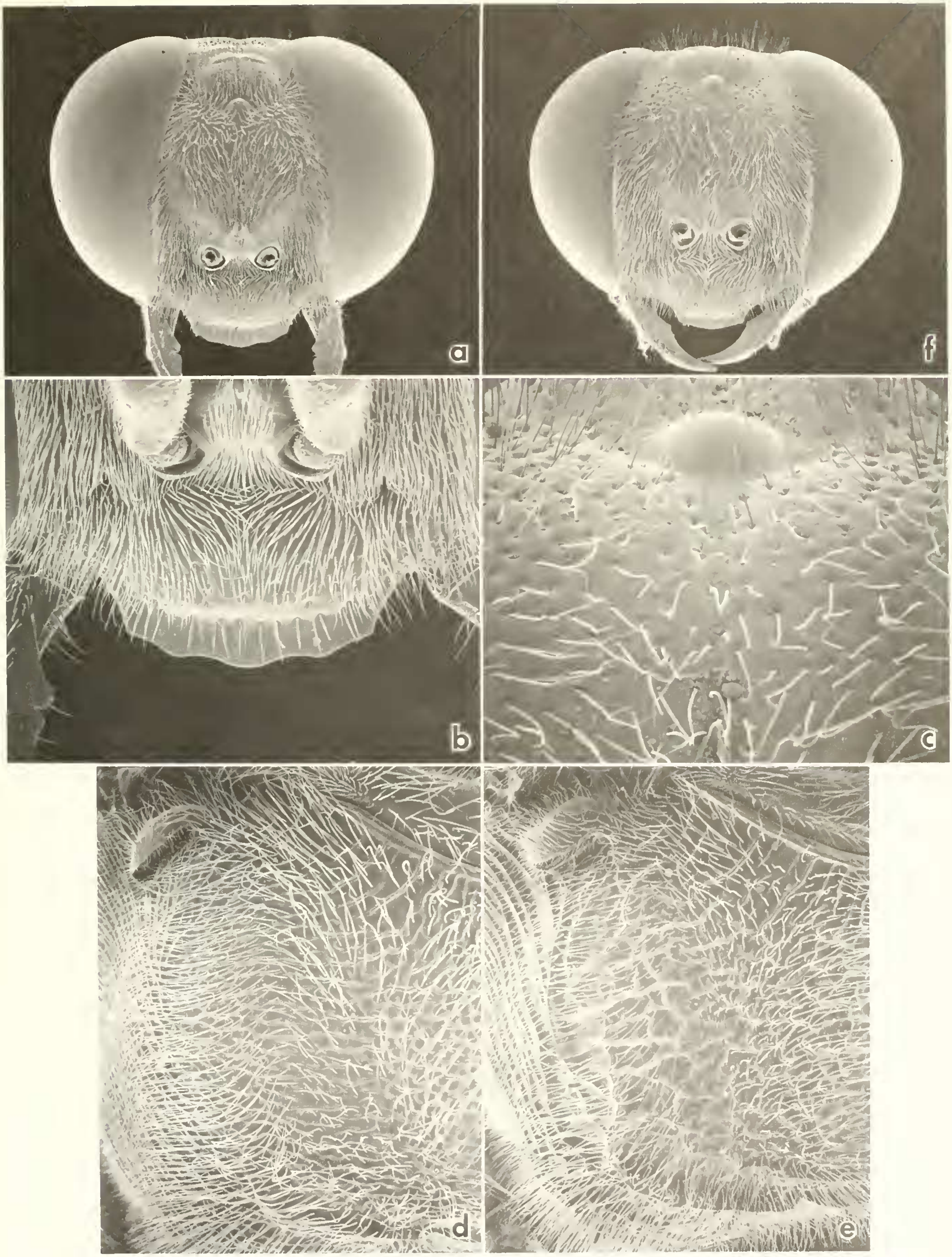

FIGURE 118 *Tachysphex apicalis* W. Fox: a—female head, front view, b—female clypeus, c—female frons adjacent to midocellus, d—propodeal dorsum of a western U.S. specimen, oblique view; e—same, Floridan specimen; f—male head, front view.

ANSP); Raleigh, North Carolina (2♀, CU, NCSU); Salisbury, North Carolina (1♀, NCSU); and Atlanta, Georgia (1♀, MCZ).

4) In Cuban specimens, the propodeal sculpture is coarse, as in the southeastern United States form, but the wings are hyaline, as in the main continental form (Pulawski 1974*a*). Also a female from El Camaron, Mexico (UCD), belongs here.

5) Hawaiian *apicalis* are morphologically identical to the main continental form, but their wings are slightly darker.

Life History.—The most striking biological property of *apicalis* is its habit of nesting in sloping banks or cliffs (Kurczewski and Snyder 1968), which may be several centimeters to many meters high. Rau and Rau (1918) recorded a female digging horizontally in an ant-lion pit, halfway down in the funnel, and I observed nests established in vertical parts of land tortoise holes (near their entrances) at the Archbold Biological Station, Florida, in April 1975. Rau and Rau (1918) observed a female digging in the mortar between the foundation rocks of an abandoned house, and Elliott and Kurczewski (1985) saw a female searching between siding shingles of a cottage.

As Kurczewski and Snyder (1968) pointed out, this unusual nest placement has further implications. First, the nest's gallery is horizontal rather than vertical (Krombein 1964). Second, the sand excavated from the burrow rolls down and cannot be reused for the nest closure. Hence, the nest remains open during the provisioning period, and the female returning with prey enters the burrow without pausing at the entrance. Only rarely, when an unusually large prey is brought in, does she stop inside the entrance and drop her prey. In this case the grasshopper is pulled inside in the manner described under *terminatus*. Third, for the final closure of the nest, sand from the sides and top of the burrow is used.

The nest has up to several cells, each filled with several prey. The prey consists of immature grasshoppers of many genera (Krombein 1967, no specific data). Williams (1914) recorded *Melanoplus* and Tryxalinae, and also *Oxya chinensis* (Thunberg) from Oahu, Hawaii (Williams 1932). Krombein (1964) found seven nymphs of a *Melanoplus*, possibly *puer* (Scudder), in a cell; they were 7–10 mm long. The egg was laid across the venter of a medium-sized nymph between the fore- and midcoxae. Elliott and Kurczewski (1985) examined an unfinished nest whose single cell contained seven nymphal acridids *Melanoplus sanguinipes* (Fabricius) and an eighth prey being carried by the female. The prey were placed head inward, venter up, or on the side.

Male behavior was studied by Kurczewski (1966*b*). The flight period begins and ends earlier in the season than the female's. After emergence males make frequent, very rapid flights back and forth in front of cliffs, landing periodically on the cliff. The perching posture is the same as in *terminatus* (see that species). Males spend the night in burrows in the cliff, but they were never observed digging. They probably use preexisting holes, as suggested by the fact that two or three males, or a male and a female, are sometimes found in the same burrow (their heads toward the entrance); another indication is that the foretarsal rake of the male is absent or rudimentary. As in *similis* and *terminatus* (see the latter species), the male frequents several perches. He also has been observed pouncing upon other males and chasing invaders that approach his perch. He may walk from his perch and explore an open hole. Unlike *similis* and *terminatus*, he often goes completely inside, turns around, and exits headfirst.

A female from Broadus, Montana (KU) was collected on flowers of *Helianthus petiolaris* Nutt.

Geographic Distribution (Fig. 119).—Transcontinental, north to Pennsylvania, Wisconsin, North Dakota, southern Alberta, and southern British Columbia, south to southern Mexico; also Cuba and introduced into the Hawaiian Islands.

The first Hawaiian specimen was taken at Waiane, Oahu, in 1931, and then a pair at Mount Kaala, Oahu, in 1939 (Williams 1931, 1932, 1940). Judging from the number of specimens preserved in various collections, *apicalis* was common at Pearl Harbor, Oahu, by 1947.

Material Examined.—Central and western form 734♀, 828♂; southeastern form 227♀, 251♂ (AMNH, ANSP, CAS, CNC, CU, FSCA, LEM, MCZ, NYSU, UCD, UGA, UMMZ, USNM, USU, WSU). Hawaiian specimens, 7♀, 12♂ (CAS, CSDA, HKT, USNM, UW).

Records.—Records without reference in parentheses refer to form 1, main continental form, (se) refers to form 2, or the southeastern form, (i) refers to form 3, or the intermediates. CANADA: **Alberta:** Medicine Hat, 12 km SW Orion, Writing-on-Stone Provincial Park. **British Columbia:** Summerland.

UNITED STATES: ALABAMA: **Montgomery:** Montgomery. ARIZONA: **Apache:** Canyon de Chelly National Monument. **Cochise. Coconino:** Cameron. **Gila:** Globe, Salt River Canyon, San Carlos. **Graham:** 4 mi W Calva, Roper Lake State Park (6 mi S Safford). **Maricopa. Mohave. Navajo:** Snowflake. **Pima. Pinal:** 14 mi E Oracle, 3 mi W Superior (Boyce Thompson Arboretum). **Santa Cruz. Yavapai:** 1 mi SE Camp Verde, Prescott. **Yuma:** 3 mi W Aztec, 10 mi N Ehrenberg, Yuma (also 30 mi NE). ARKANSAS: **Conway:** —. CALIFORNIA: **Alameda:** Niles Canyon, Sycamore Grove State Park (3 mi S Livermore), Tesla Road. **Alpine:** Silver Creek. **Colusa:** Colusa. **Contra Costa. El Dorado:** Snowline Camp. **Fresno:** Warthan Canyon, 8 mi NW Coalinga. **Glenn:** Hamilton City. **Imperial. Inyo. Kern:** Antelope Canyon near Tehachapi, Maricopa, 7.3 mi E Weldon. **Lassen:** Hallelujah Junction, Wendel. **Los Angeles. Modoc:** Fort Bidwell. **Mono. Monterey:** Arroyo Seco, Paraiso Springs. **Napa:** Samuel Springs (now bottom of Lake Berryessa). **Nevada:** Boca. **Orange:** Crystal Beach, Irvine Park, Santa Ana. **Placer. Riverside. Sacramento:** 2 mi E Fair Oaks, Folsom, Sacramento. **San Benito:** New Idria Road 4 mi SW Junction Panoche Road. **San Bernardino. San Diego. San Mateo:** Redwood City. **Santa Barbara:** including Santa Cruz Island. **Santa Clara:** Palo Alto. **Santa Cruz:** —. **Shasta:** Cassel, Redding, 2 mi W Shingletown. **Solano:** 8 mi W Winters. **Sonoma:** Healdsburg, Maacama Creek. **Stanislaus:** Del Puerto Canyon, Knight's Ferry. **Trinity:** Junction City. **Tulare:** Kennedy Meadow. **Ventura:** Oxnard, Wagon Road No. 2 Campground (18 air mi WSW Gorman). **Yolo:** Davis, Elkhorn Ferry, Rumsey, opposite Sacramento. COLORADO: **Alamosa:** Great Sand Dunes. **Boulder:** Boulder. **Chaffee:** Buena Vista. **Crowley:** Olney Springs. **Eagle:** State Bridge near Bond. **Larimer. Mesa:** Colorado River S Loma. **Moffat:** Sunbeam. **Montezuma:** 3 mi W Arriola. **Weld:** Owl Creek (12 mi NE Nunn), 1 mi NE Roggen. DISTRICT OF COLUMBIA: Washington (partly se). FLORIDA (se): **Alachua:** Gainesville, Monteoca (11 mi NW Gainesville). **Bradford:** —. **Brevard:** Cocoa. **Broward:** Hollywood. **Clay:** Camp Crystal. **Collier:** Corkscrew Swamp Sanctuary. **Dade:** Miami. **DeSoto:** Arcadia. **Duval:** Jacksonville. **Glades:** Lakeport. **Gulf:** Port St. Joe. **Hendry:** Devil's Garden (23 mi SW Clewiston). **Highlands:** Lake Placid, Sebring, Venus. **Lee:** Sanibel Island. **Levy:** Cedar Key. **Marion:** 9 mi SSW Ocala, Ocala National Forest. **Monroe:** Fleming Key. **Orange:** Orlando, Winter Park. **Osceola:** Kissimee. **Polk:** Indian Lake Estates. **Putnam:** Georgetown, 2 mi NW Orange Springs, Red Water Lake, Welaka. **St. John's:** St. Augustine. **St. Lucie:** Fort Pierce. **Santa Rosa:** —. GEORGIA: **Decatur:** Bainbridge (se). **Fulton:** Atlanta (i). **Liberty:** St. Catherine's Island (se). **Richmond:** Fort Gordon (se). **Tift:** Tifton (se). HAWAII: **Oahu:** Mt. Kaala (Williams 1940), Pearl Harbor, Waiane (Williams 1931, 1932). IDAHO: **Ada:** Lucky Peak Reservation. **Canyon:** 2 mi N Melba, Murphy. **Cassia:** Murtaugh. **Elmore:** 3.9 mi W Hamett, Mayfield, 16 mi SW Mountain Home, Mountain Home Air Base. **Franklin:** 12 mi NE Preston, Weston Canyon. **Fremont:** St. Anthony, St. Anthony Sand Dunes. **Gooding:** 1 mi NE Gooding. **Lemhi:** 9 mi N Ellis. **Nez Perce:** Central Grade, Lewiston. **Oneida:** Black Pine Canyon. **Owyhee:** Hot Spring. **Twin Falls:** Hansen, Hollister. ILLINOIS: **Macoupin:** Carlinville. INDIANA: **Porter:** Dune Acres. IOWA: **Polk:** Ankeny. **Woodbury:** Sioux City. KANSAS: **Barton:** Great Bend. **Douglas:** Lawrence (also 5 mi NW). **Grant:** —. **Kearny:** Lakin (also 9.5 mi S). **Marshall:** Blue Rapids. **Ness. Russell:** —. KENTUCKY (i): **Jefferson:** Louisville. **Marion:** Nerinx.

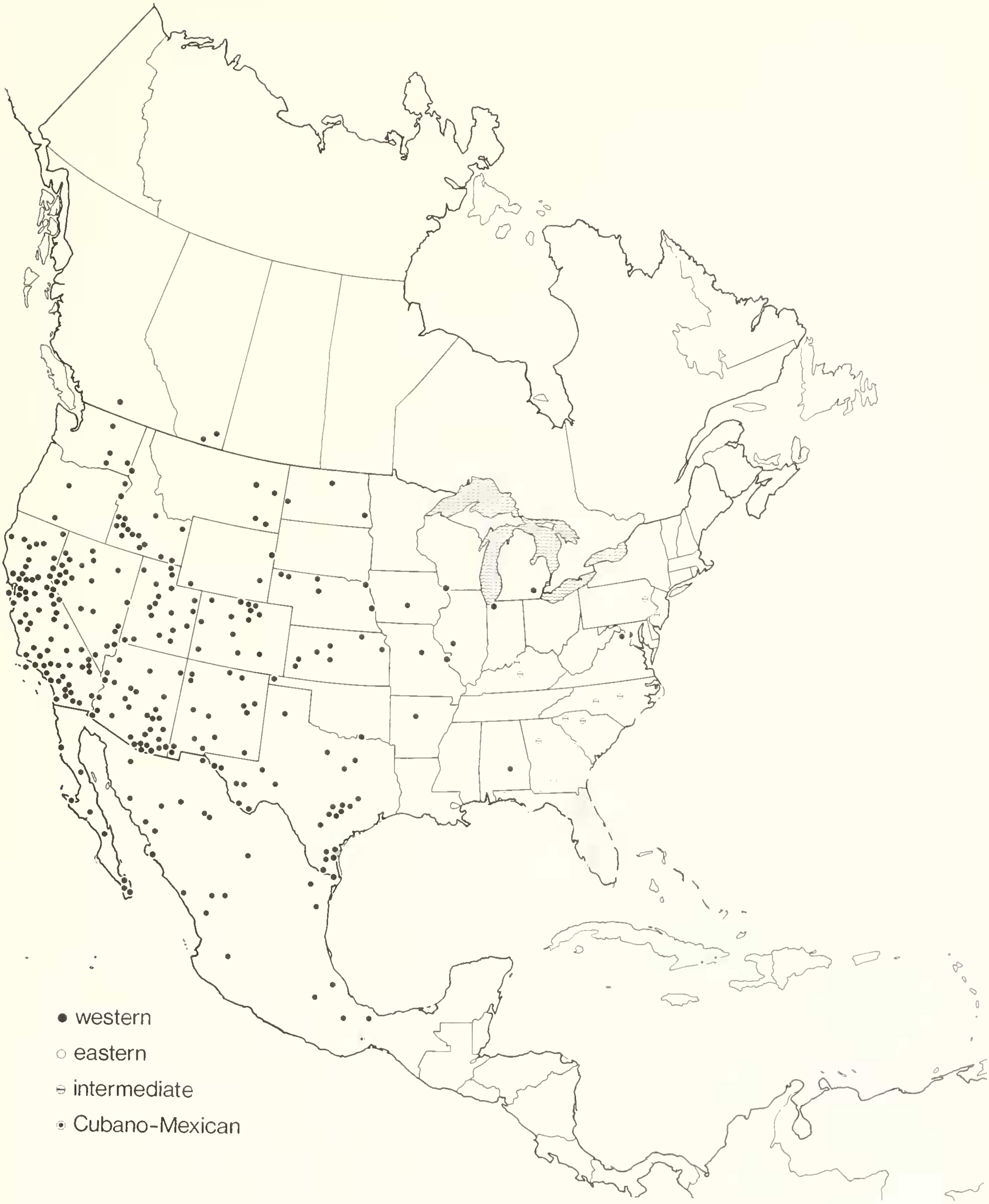

FIGURE 119. Geographic distribution of *Tachysphex apicalis* W. Fox.

MICHIGAN. **Washtenaw:** Ann Arbor (Matthaei Botanical Garden). MISSOURI. **Boone:** Columbia. **St. Louis City:** St. Louis. MONTANA. **Dawson:** Glendive. **Garfield.** 5 mi W Jordan. **Powder River:** Broadus. **Rosebud:** Ashland. NEBRASKA. **Cherry:** Valentine. **Dawes:** Chadron. **Douglas:** Omaha. **Sioux:** Sawbelly Canyon, Toadstool Park. **Thomas:** Halsey, Nebraska National Forest (2.5 mi W Halsey), Thedford. NEVADA. **Churchill. Clark. Douglas:** Minden. **Elko:** Lamoille Canyon (Ruby Mts.). **Humboldt:** 5 mi E Golconda, Orovada, Soldier Meadows. **Lander:** 20 mi SW Austin. **Lincoln. Mineral:** 5 mi NW Schurz. **Nye:** 24 mi E Tonopah, 4 mi W Warm Springs. **Pershing:** 7 mi E Oreana. **Washoe. White Pine:** Baker. NEW JERSEY. **Gloucester:** Woodbury (t). NEW MEXICO. **Catron:** Pie Town. **Colfax:** 2 mi W Ute Park. **De Baca:** Sumner Lake State Park. **Dona Ana:** 12 mi N Las Cruces, Mesilla. **Eddy:** Carlsbad. **Guadalupe:** Santa Rosa. **Hidalgo:** 9 mi N Cotton City, Rodeo (also 18 mi N), Skeleton Canyon (Peloncillo Mts.). **Otero:** Alamogordo. **Quay:** Tucumcari. **San Juan:** 3 mi S Naschitt, Newcomb, 43 mi S Shiprock. **Sierra:** Percha Dam State Park. **Socorro:** La Joya (20 mi N Socorro). **Taos:** 17 mi NW Taos. NORTH CAROLINA. **Moore:** Southern Pines (se). **Onslow:** Onslow Beach (se). **Rowan:** Salisbury (t). **Wake:** Raleigh (t). NORTH DAKOTA. **Golden Valley:** Beach. **McHenry:** Towner. **Richland:** 13 mi W Walcott. OKLAHOMA. **Cimarron:** Black Mesa State Park. **Marshall:** 2 mi E Willis (Lake Texoma). OREGON. **Baker:** Robinette. **Deschutes:** 9 mi E Redmond. **Klamath:** Klamath Falls. **Wallowa:** 5 mi W Imnaha. PENNSYLVANIA. **Lehigh:** Lehigh Gap (t). SOUTH CAROLINA. **Greenville:** Greenville (t). **Union:** Santuc (t). TEXAS. **Bastrop:** 6 mi E Bastrop. **Bexar:** Fort Sam Houston. **Brewster:** Big Bend National Park (Castolon), Chisos Mts., 34 mi S Marathon. **Caldwell:** Luling, Maxwell. **Cameron:** Brownsville. **Comal:** New Braunfels. **Dallas:** Dallas. **Duval:** Benavides, 18 mi N San Diego. **Hidalgo:** Bentsen Rio Grande Valley State Park. **Hudspeth:** Fort Hancock, McNary, 5 mi N Sierra Blanca. **Jeff Davis:** 21 mi W Fort Davis, Limpia Canyon near Fort Davis. **Jim Wells:** Palito Blanco. **Kleberg:** Baffin Bay 20 mi SE Kingsville. **Lee:** Ledbetter. **Pecos:** Sheffield. **Presidio:** 3 mi E Presidio. **Randall:** Palo Duro Canyon State Park. **Robertson:** Hearne. **San Patricio:** Corpus Christi, 5 and 10 mi NE Sinton. **Somervell:** Dinosaur Valley State Park. **Travis:** Austin. **Ward:** Monahans Sandhills State Park. **Williamson:** Taylor. **Young:** Newcastle. UTAH. **Box Elder:** Lucin. **Cache. Emery:** 9 air mi E Castle Dale, N Goblin Valley (Buckskin Spring, Wild Horse Creek), Highway 24 N Wayne County line. **Garfield:** Cass Creek Reserve, Mount Hillers (E slope), Shootaring Canyon. **Grand:** Arches National Monument. **Juan:** 12 mi S Eureka, 10 mi NE Leamington. **Millard:** Delta, Fillmore (also 12 mi NW), 10 mi W Patton. **Summit:** Wanship. **Tooele:** Delle. **Uintah:** SW Bonanza, 6 mi N Vernal, Watson. **Washington.** VIRGINIA. **Loudoun:** —. WASHINGTON. **Benton:** Richland. **Franklin:** Hanford Reserve near Richland, Pasco. **Grant:** O'Sullivan Dam. **Okanogan:** Malott. **Whitman:** Wawawai. WISCONSIN. **Grant:** Rutledge. WYOMING. **Platte:** Wheatland. **Uinta:** Mountain View. **Weston:** New Castle.

MEXICO. **Baja California Norte:** El Consuelo. **Baja California Sur:** 30 mi ESE Bahia Tortugas, El Pescadero, 25 km SE Laguna Chapala, La Paz, Los Barriles, 4 mi WSW Miraflores, Playa Los Cerritos (11.2 mi S Todos Santos), 24 km W San Ignacio, 3 mi NE San Isidro. **Chihuahua:** 30 mi NW Ceballos, Chihuahua (also 35 mi NW), Samalayuca Dunes, Santa Clara Canyon (5 mi W Parrita). **Durango:** 5 mi W Durango. **Jalisco:** Guadalajara, Ixtlahuacan Del Rio. **Mexico:** Teotihuacan pyramids. **Morelos:** 3 mi N Alpuyeca. **Nayarit:** 22°20′N, 104°25′W. **Nuevo Leon:** Huasteca near Monterrey, S Montemorelos. **Oaxaca:** El Camaron (propodeum and wings as in Cuban specimens). **Puebla:** 3 mi NW Petlalcingo, 2 mi NW Tehuacan. **Sinaloa:** Chupaderos, 8 mi SE Elota, Topolobampo. **Sonora:** Alamos (also 10 mi SE), Bahia San Carlos, Ciudad Obregon, Cocorit, 5 mi W Santa Ana, 60 km NW Yecora. **Tamaulipas:** Ciudad Victoria, Matamoros. **Veracruz:** 5 mi SW Perote, Tinajas. **Zacatecas:** 15 mi E Sombrerete.

CUBA (Pulawski 1974*a*). **Oriente:** Ciudemar near Santiago de Cuba, Tortuguilla.

brullii Species Group

The *brullii* group (*bicolor* group of Pulawski 1971, 1974*a*) contains species in which the females have modified apical tarsomeres (males do not have group characters). The female's apical tarsomere is convex dorsally, its apicoventral margin is produced into a lobe or at least arcuate, and the venter is variously modified (covered with erect setae except glabrous basally or angulate basally in lateral view or densely spinose); the claws can be appressed to the venter of the apical tarsomere so that claw's apex reaches the tarsomere's base. In two South American species, *acutemarginatus* Strand and *pectinatus* Pulawski, the apical tarsomeres are weakly modified (the apicoventral margin is weakly arcuate), but I assigned them to the *brullii* group (Pulawski 1974*a*) because the setae of the propodeal dorsum are erect and slightly inclined posterad. In many species (including all North American), the female's pygidial plate is broadly rounded apically. In other groups the female's apical tarsomere is weakly convex dorsally, with the apicoventral margin straight or nearly so; the venter is evenly covered with setae that are mostly inclined (erect in *verticalis*), and a few spines are present in some species; the claws' movements are restricted so that their tips never reach the tarsomere's base. No character is known to distinguish the males of the *brullii* group from those of the *pompiliformis* group, but some features help in recognition. Setae of the propodeal dorsum (at least on its lateral and posterior parts) are erect or oriented posterad in most members of the *brullii* group. Exceptions to this are as follows. The anteriorly oriented setae form a narrow band from base to apex in the Australian *vardyi* Pulawski, and a broad band in *maya* and the Australian *politus* Pulawski and *vividus* Pulawski. All setae are inclined obliquely forward in *brevicornis* Pulawski (Australia) and the majority of species belonging to other groups. In *apricus* of the *pompiliformis* group, the basomedian setae are oriented obliquely anterad, but the lateral setae are oriented posterad toward the midline and join apicomesally (a condition found in most members of the *brullii* group).

Known prey in the *brullii* group are either tettigoniids or blattids. Tettigoniids are used by *belfragei*, *menkei*, *mundus*, and the Palearctic *brullii*, whereas blattids are prey of *alayoi*, *inconspicuus*, *iridipennis*, the Palearctic *blattivorus* Gussakovskij and *obscuripennis* (Schenck), the Australian *depressiventris* Turner, *fanuensis* Cheesman from Oceania, and *nigerrimus* (F. Smith) from New Zealand. The shape of the female tarsus possibly is related to prey type, perhaps being an adaptation to a particular way of capturing or carrying prey. In the known tettigoniid hunters, the penultimate tarsomeres are about as wide as long, acutely emarginate dorsally, and roundly emarginate apicoventrally; the apical tarsomeres and claws are long, slender, and the apical tarsomeres are not angulate basoventrally in lateral view. Many other species of the *brullii* group have the same tarsi, and I expect them to be tettigoniid hunters as well. In all known blattid hunters, the penultimate tarsomeres are wider than long, obtusely angulate or rounded apically, and produced into a lobe apicoventrally; the apical tarsomeres and claws are short, stout, and the apical tarsomeres are angulate basoventrally in lateral view.

De Beaumont (1936) and also Menke (*in* Bohart and Menke 1976) placed the tettigoniid collectors and the roach hunters in two separate groups, the *brullii* group and the *obscuripennis* group, based on the shape of the female tarsi and nature of their prey. I have combined these two groups (Pulawski 1971, 1977*a*) because some species do not fit either of these categories and their prey is unknown. For example, in the Australian species *stimulator*, the penultimate tarsomere is wider than long, obtusely emarginate dorsally, and shallowly, roundly emarginate apicoventrally, and the apical tarsomere and the claws are long, but the tarsomere is slightly angulate basoventrally. In *verhoeffi* Pulawski (eastern Mediterranean), the penultimate tarsomere is slightly wider than long, roundly emarginate both ventrally and dorsally (shallowly so on venter), and the apical tarsomere and tarsi are even longer and more slender than in *stimulator*, but the tarsomere is weakly angulate basoventrally. In the South American *acutemarginatus* Strand, the penultimate tarsomere is longer than wide, acutely emarginate dorsally, and almost straight apicoventrally, and the apical tarsomere and claws are short, stout, but not angulate basally. For convenience's sake, I recognize the *brullii* subgroup and the *obscuripennis* subgroup in this paper in spite of intermediates found in other zoogeographic regions.

The *brullii* group is cosmopolitan, but is dominant in the Australian Region (32 out of 40 known Australian species of *Tachysphex*).

brullii Subgroup

Vertex longer than wide (as long as wide in some males of *acanthophorus* and *aequalis*). Scutum and scutellum convex. Outer face of female foretibia with spines. Tarsomere IV longer than wide, with apical emargination acute (Fig. 121a), but roundly V-shaped in *menkei*; apicoventral margin concave mesally. Tarsomere V not angulate basoventrally in lateral view (Fig. 121b); claws slender, long (arolium attaining at most their midlength), more or less asymmetrical (one claw in each pair being slightly smaller than the other). Forebasitarsus with 9–14 rake spines in most species, but 7–9 in *armatus*, 5–9 in *acanthophorus*, and 5 in *cocopa*. Male foretarsus without rake, but outer apical spine of foretarsomere II may be as long as foretarsomere III in *menkei*.

Species of the *brullii* subgroup prey upon Tettigoniidae. They occur in all zoogeographic regions.

Tachysphex mundus W. Fox

(Figures 120–122)

Tachysphex exsectus W. Fox, 1894*a*:526, ♀, ♂. ! Lectotype: ♀, Montana: no specific locality (ANSP), designated by Cresson 1928:44. Synonymized with *mundus* by Pulawski *in* Krombein 1979:1632.—Dalla Torre 1897:679; Ashmead 1899: 250 (as *excatus*); G. Bohart 1951:951, Krombein 1967:393, Bohart and Menke 1976:273.—As *mundus exsectus*: Elliott and Kurczewski 1985:296.

Tachysphex mundus W. Fox, 1894*a*:531, ♀, ♂. ! Lectotype: ♀, Illinois: no specific locality (ANSP), designated by Cresson 1928:45.—Dalla Torre 1897:681, Ashmead 1899:250; H. Smith 1908:380; Stevens 1917:422; Mickel 1918:424, Robertson 1928:121, 128, 135, G. Bohart 1951:951, Krombein 1967:393; Bohart and Menke 1976:275, Kurczewski 1979:641 (life history).

Tachysphex johnsoni Rohwer, 1911:573, ♀. ! Holotype: ♀, Colorado: Washington Co.: Cope (USNM). **New synonym.** As synonym of *aequalis*: G. Bohart 1951: 950.

Diagnosis.—*Tachysphex mundus* can only be identified by a large suite of characters in combination. The head and thorax setae are straight in *mundus* (woolly in *menkei*), the scutal corner is rounded (Fig. 120c) (prominent in *maurus*, *robustior*, and *utina*, Fig. 125a, b), the scutal punctures are one diameter apart or less (more than one diameter apart in *menkei* and most *maurus*), the midscutal setae are oriented evenly posterad (oriented laterad in *acanthophorus*, *armatus*, and *cocopa*), the mesopleural punctures are fine or evanescent (large in *maya*), the propodeal dorsum is evenly microareolate (Fig. 120d, e) (rugose in *belfragei*), and the setae of the propodeal dorsum are oriented posterad except on a basomedian, triangular area where they are oriented anterad (Fig. 120d) (in *maya*, the setae are oriented anterad on a broad median zone that extends from the base to apex). In the female, the clypeal lip is not expanded (Fig. 120a) (expanded mesally in *belfragei* and *krombeiniellus*, Fig. 128a), tarsomere V has no basoventral spines (Fig. 121c) (present in *armatus*), or midventral spines (present in *armatus*, *cocopa*, and most *acanthophorus*). In the male, sterna III–VI have graduli (Fig. 121f) (a transverse sulcus in *acanthophorus*, *armatus*, and *cocopa*), sterna III–VI lack apical setal fasciae (present in *robustior*), and the tibiae are red (black in *aequalis*, *maurus*, *robustior*, and *utina*). The combination of red tibiae and an all black gaster is distinctive for many males of *mundus*. However, the gaster is partly red in many specimens, which may be confused with *krombeiniellus*. Unlike that species, the thoracic vestiture of *mundus* is silvery (and not golden), the vertex setae are inclined or erect (and not appressed), and the apical (broad) portion of the penis valve is not elongate. The distance between the clypeal lip corners of *mundus* is about equal the clypeal length (about 1.25 clypeal length in *aequalis*).

Females of *mundus* are very similar to *aequalis*, and their separation is complicated by exceptions. The gaster color of *mundus* is either all black or basally red. Black specimens are all *mundus*, but the bicolored ones may be either species. The closely punctate mesopleuron is diagnostic for *mundus*, but in some black specimens the punctures are two to three diameters apart. In *aequalis*, the gaster is bicolored (all red in some individuals), and the mesopleural punctures are two to five diameters apart (Fig. 123a, b). In addition, nearly all *mundus* lack spines on the lateroventral margin of hindtarsomere V, while in most *aequalis* one or two small spines are present. Also, *mundus* occurs east of the Rocky Mountains and *aequalis* west of the Rocky Mountains, but their ranges overlap in Colorado.

Description.—Scutum dull, not prominent posterolaterally (Fig. 120c), its punctures no more than one diameter apart. Mesopleuron markedly microsculptured, impunctate, or with shallow punctures that are less than one to slightly more than one diameter apart at middle, but up to two or three diameters apart in a female from Richmond, Texas (CAS) with all black gaster. Propodeal dorsum evenly microareolate (Fig. 120d, e); side conspicuously microsculptured, indistinctly microrugose in some specimens, rarely ridged posteriorly. Terga densely micropunctate.

Setae suberect to erect on vertex, appressed or nearly so on mesothorax and femora; integument easily visible. Scutal setae oriented posterad. Setae length (in MOD) 0.8 along hypostomal carina, 0.8–1.0 on vertex, 0.8–1.2 on propodeal dorsum.

Head and thorax black. Terga I–IV silvery fasciate apically. Wings weakly infumate to almost hyaline.

♀.—Labrum emarginate (Fig. 120b). Clypeus (Fig. 120a): bevel longer than basomedian area; lip not broadened, with or without median notch, with two lateral incisions on each side. Dorsal length of flagellomere I 1.3–1.9× apical width. Vertex punctures more than one diameter apart, at least mesally. Pygidial plate sparsely setose (Fig. 120f), broad or (few specimens) narrow. Tarsomere V of most specimens without spines on venter or margins (Fig. 121a–c), but one spine present on inner margin of left hindtarsomere in a female from Padre Island, Texas (CAS). Length 7.4–10.5 mm.

Femora black, tibiae black or with reddish zones, rarely red (some females of central United States form from Montana). A female from Moenkopi, Arizona, has all red hindfemur and hindtibia and largely red fore- and midtibia.

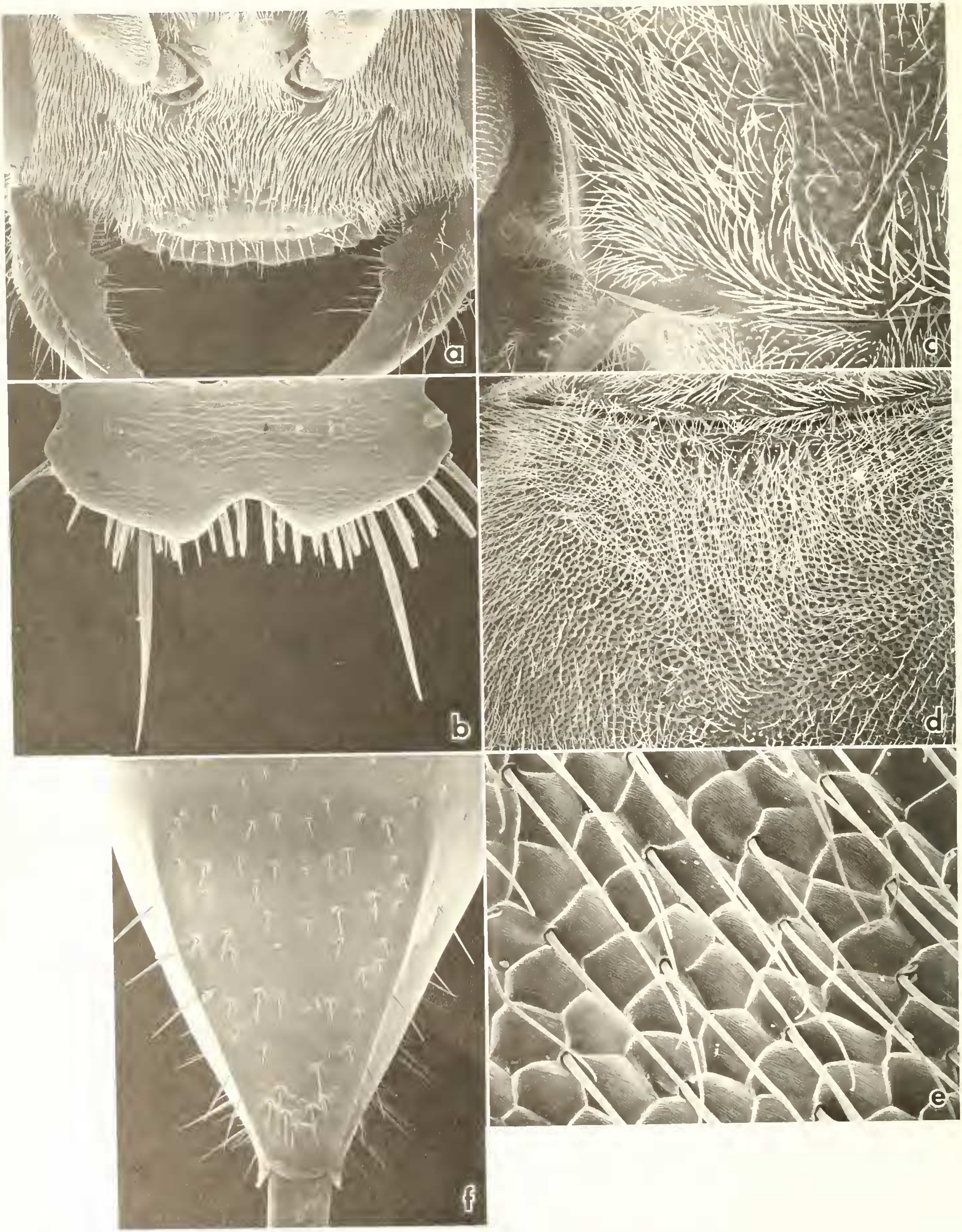

FIGURE 120. *Tachysphex mundus* W. Fox, female: a—clypeus, b—labrum, c—scutal hindcorner; d—propodeal dorsum (note anterad oriented setae in the middle and posterad oriented setae on the sides), e—sculpture of propodeal dorsum, f—pygidial plate.

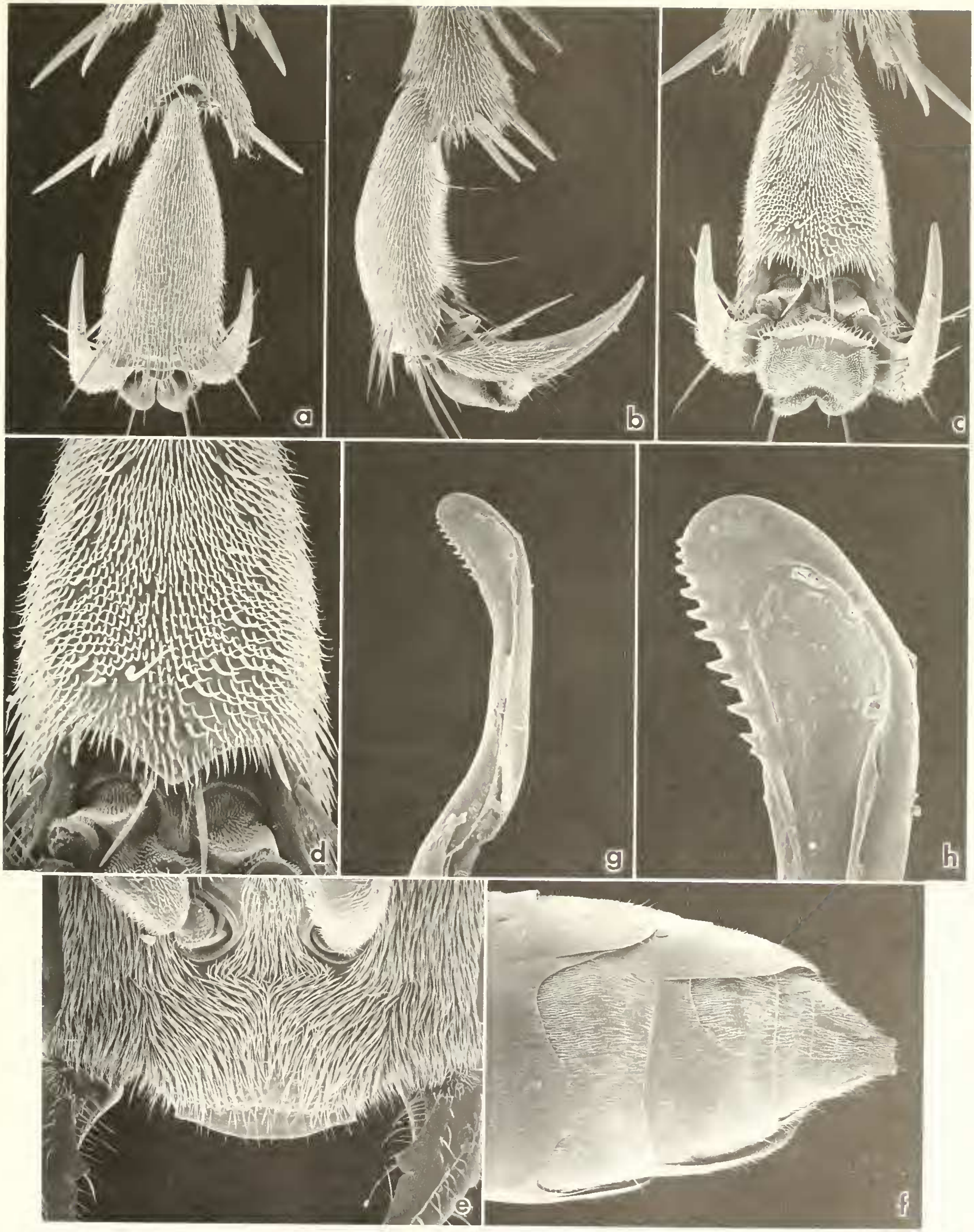

FIGURE 121. *Tachysphex mundus* W. Fox: a—apical hindtarsomere of female, dorsally; b—same, laterally; c—same, ventrally; d—same, higher magnification; e—male clypeus; f—gastral sterna of male; g—penis valve; h—penis valve, apical portion.

♂.—Clypeal bevel shorter than basomedian area or absent; lip arcuate or slightly concave on each side; distance between lip corners about equal to clypeal length (Fig. 121). Dorsal length of flagellomere I 1.1–1.4× apical width. Vertex punctures fine, about one diameter apart. Sterna pubescent throughout; sterna III–VI with graduli (Fig. 121f). Length 5.5–8.5 mm. Penis valve: Figure 121g, h.

Tibiae and tarsi red, frontal vestiture golden or (some specimens) silvery.

Geographic Variation.—*Tachysphex mundus* varies geographically in the color of the gaster as outlined below:

1) Gaster black in most individuals east of the Mississippi River (in all individuals from Florida and mid-Atlantic states), and also in many specimens west of Mississippi. This form can be called *mundus mundus* by those who accept trinominal nomenclature.

2) Gastral segments I to I–III are red in most individuals west of the Mississippi River and also in some specimens east of the Mississippi (including one from Raleigh, North Carolina). In addition, the mesopleuron usually has shallow, dense punctures. The name *mundus exsectus* (=*johnsoni*) is available for this form.

Individuals with an all black gaster, with reddish zones on terga I and II, and with red terga I and II, occur together in the following areas: Iowa: Ames and Sioux City; Kansas: Lawrence; Nebraska: Omaha and West Point; Wisconsin: Prescott, Rutledge, Olmsted Co.

Life History.—H. Smith (1908) observed this species on flowers of *Cassia* and *Euphorbia*, and Robertson (1928) on flowers of *Chamaecrista fasciculata* (Michx.) Greene (as *Cassia chamaecrista* (L.)), *Pycnanthemum flexuosum* (Walt.) B.S.P., and *Strophostyles helvola* (L.) Ell. The nesting behavior of *mundus* was studied by Kurczewski (1979). Females searching for a place to nest fly slowly over the ground in gravelly, sandy, or clayey areas. They land periodically, enter cracks and crevices in the soil, and open holes and burrows made by other insects, especially bees. They dig their own nests from the vertical burrows of bees or sphecids; in one case observed, two nests were excavated from a single burrow, but on opposite sides. A female began digging her nest with her mandibles and forelegs in the nest of the bee *Nomia heteropoda* (Say), 2 cm below the entrance. She dug in a lateral direction, nearly perpendicular to the bee shaft. Four times she interrupted her digging, left the tunnel headfirst, turned around, and reentered. Finally, she made several orientation flights and left the area. The nest of *mundus* is unicellular. The known prey consists mainly of nymphal tettigoniids: *Conocephalus* sp., *Orchelimum* sp., and a species that probably is *Odontosiphidium apertum* Morse. However, two cells in Kansas contained mixed prey: the tettigoniids *Conocephalus* sp. (eight nymphs) and *Orchelimum* sp. (five nymphs), and the gryllid *Oecanthus argentinus* Saussure (three nymphs). The prey are incompletely paralyzed, as demonstrated by movements of their antennae and mouthparts and breathing movements of the abdomen. They are transported to the nest in flight, dorsum up and head forward; their antennae are held with the wasp's mandibles; and their body is clutched with her legs. The wasp hovers above the entrance momentarily and then plunges inside (this description suggests that the nest is permanently open during the provisioning period). The prey are stored dorsum up or venter up, three to six per cell. No preference was observed in the choice of prey for egg deposition: it may be the heaviest or the lightest one, the one closest to the surface, or one laying on the cell floor. The egg is placed across the prey's body behind its forecoxa.

Geographic Distribution (Fig. 122).—North America east of the Rocky Mountains, north to Long Island, New York, Saskatchewan and southern Alberta, south to Florida and Tamaulipas, Mexico.

Material Examined.—203♀, 187♂ of form 1 (*mundus mundus*), and 97♀, 95♂ of form 2 (*mundus exsectus*).

Records (m: form 1; e: form 2).—CANADA. **Alberta** (e): Medicine Hat, 12 km S Orion, Picture Butte, Writing-on-Stone Provincial Park. **Saskatchewan** (e): Landing, 21 mi W Moose Jaw.

UNITED STATES. ALABAMA (m): **Baldwin:** Gulf Shores. ARIZONA (m): **Cochise:** Hereford. ARKANSAS: **Arkansas:** Arkansas River (m). **Hempstead:** Hope (e). COLORADO (e except Boulder): **Alamosa:** Great Sand Dunes. **Bent:** Hasty. **Boulder:** Boulder (partly b). **El Paso:** Colorado Springs. **Logan:** —. **Montrose:** Dolores Canyon. **Prowers:** Carlton. **Routt:** 7 mi E Hayden. **Washington:** Cope. **Weld:** Owl Creek (19 mi NE Nunn). DISTRICT OF COLUMBIA (m): Washington. FLORIDA (m): **Alachua:** Alachua, Gainesville, Monteoca (11 mi NW Gainesville). **Bradford:** —. **Brevard:** Cocoa. **De Soto:** Arcadia. **Flagler:** —. **Gadsden:** Quincy. **Gulf:** —. **Hardee:** Zolfo Springs. **Highlands:** Highlands Hammock State Park, Lake Annie, Lake Placid. **Leon:** Tall Timbers Research Station. **Levy:** Cedar Key. **Liberty:** Torreya State Park. **Orange:** Winter Park. **Polk:** —. **Putnam:** Crescent City, 2 mi NW Orange Springs, Palatka, Red Water Lake, Welaka. **Suwannee:** Suwannee River State Park. GEORGIA (m): **Charlton:** Billy's Island (Okefenokee Swamp). **De Kalb:** Stone Mountain. **Glynn:** Brunswick. **Macon:** Oglethorpe. **Mitchell:** DeWitt. **Richmond:** Augusta, Fort Gordon. **Tift:** Tifton. ILLINOIS: Chicago (e). **Macoupin:** Carlinville (m, e). **Mason:** Sand Ridge State Forest (m). IOWA. **Jackson:** Bellevue (m, e). **Story:** Ames (m, e). **Woodbury:** Sargeant Bluff (e), Sioux City (m, e). KANSAS (e if not indicated otherwise): **Dickinson, Reno:** —. **Douglas:** Lawrence (m, e). **Kiowa:** Belvidere. **Pottawatomie:** Blackjack Creek. **Scott:** —. MARYLAND (m): **Calvert:** Chesapeake Beach. **Prince Georges:** Beltsville, Patuxent Wildlife Research Center. MICHIGAN (m): **Gratiot:** —. **Livingston:** E. S. George Reserve. **Mecosta:** —. **St. Joseph:** Klinger Lake. MINNESOTA: **Hennepin:** Minneapolis (m). **Olmsted** (m, e): —. **Ramsey:** New Brighton (e). MISSISSIPPI (m). **Lafayette:** Oxford. MONTANA. —(e). NEBRASKA. **Cuming:** West Point (m, e). **Dawes:** Chadron (e). **Douglas:** Omaha (m, e). **Keith:** Ogallala (e). **Scotts Bluff:** Mitchell (e). **Sheridan:** Rushville (e). **Sioux:** Harrison (e), Monroe Canyon (e), Toadstool Park (m). **Thomas:** 2.5 mi W Halsey (m). NEW JERSEY (m): **Burlington:** Lebanon State Forest, Moorestown, Riverton. **Cape May:** —. **Union:** Westfield. NEW MEXICO. **Quay:** Tucumcari (e). **Roosevelt:** Oasis State Park (e). **Socorro:** La Joya (20 mi N Socorro) (e). NEW YORK. **Nassau:** Roslyn Heights (m). NORTH CAROLINA. **Brunswick:** Wilmington (m). **Cumberland:** Fort Bragg (m). **Moore:** Southern Pines (m). **Wake:** Raleigh (e). NORTH DAKOTA (e): **Burleigh:** Bismarck. **Golden Valley:** Beach. **Ransom:** 3 mi N McLeod, 7 mi SE Sheldon. OKLAHOMA. **Marshall:** Lake Texoma (2 mi E Willis) (m, e). SOUTH CAROLINA. **Aiken:** New Ellenton (m). SOUTH DAKOTA (e): **Butte:** Orman Dam. **Fall River:** Hot Springs. TENNESSEE. **Davidson:** Madison (m). TEXAS: **Anderson:** Salmon (m, e). **Aransas:** Aransas National Wildlife Refuge (m). **Atascosa:** Pleasonton (m, e). **Bastrop:** 6 mi E Bastrop (m). **Bexar:** Helotes (m), —(m, e). **Bosque:** Whitney Dam (m). **Brazos:** —(m). **Brewster:** 34 mi S Marathon (m), Rio Grande Village (m). **Caldwell:** Luling (e). **Comal:** New Braunfels (m). **Duval:** 18 mi N San Diego (m). **Fort Bend:** Richmond (m). **Hidalgo:** Edinburg (m), McAllen Botanical Garden (m). **Jim Wells:** Palito Blanco (m). **Kerr:** —(m). **Kenedy:** 3 mi S Sarita (e). **Kleberg:** Baffin Bay 20 mi SE Kingsville (m, e), Kingsville (m). **Lee:** Fedor (m, e). **Nueces:** Padre Island (e). **San Patrizio:** Aransas River 10 mi NE Sinton (e). **Travis:** Austin (m). **Victoria:** Victoria (e). **Ward:** S Grandfalls (m). **Williamson:** Taylor (m). VIRGINIA (m): **Arlington:** Arlington. **Fairfax:** Falls Church, Vienna. WISCONSIN. **Grant:** Rutledge (m, e), Wyalusing (m). **Pierce:** Prescott (m, e). **St. Croix:** Hudson (e). **Vernon:** Genoa (e).

MEXICO: **Tamaulipas:** Matamoros (m), Rio Corona 18 mi N Ciudad Victoria (m).

Tachysphex aequalis W. Fox, revised status

(Figures 123, 124)

Larra rufitarsis Cameron, 1889:50, ♂.[1] Holotype: ♂, Mexico: Sinaloa: Presidio near Mazatlan (BMNH). Nec Spinola, 1851. Synonymized with *aequalis* by Bohart and Menke 1976:272.

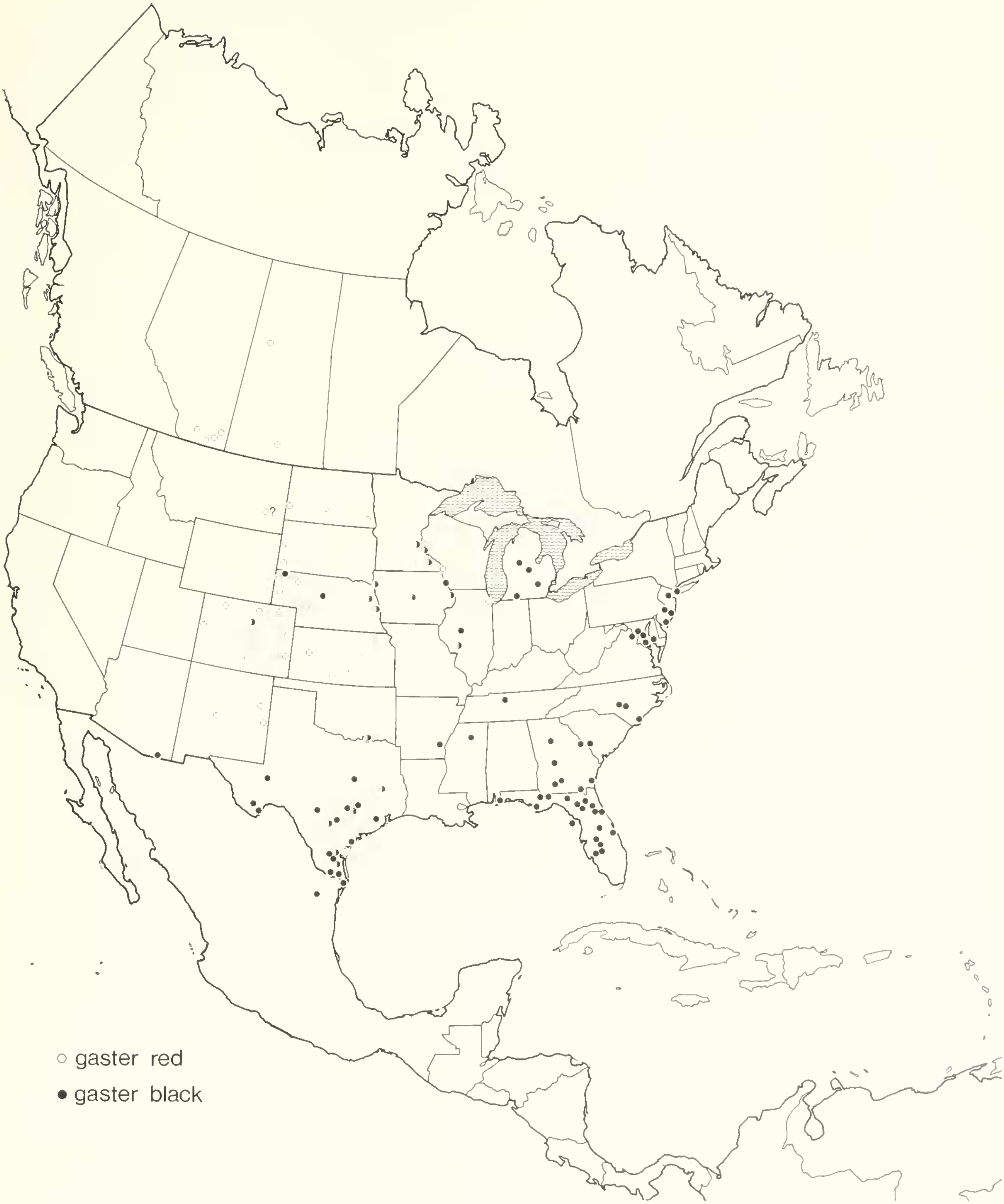

FIGURE 122. Geographic distribution of *Tachysphex mundus* W. Fox.

Tachysphex aequalis W. Fox, 1894a:51. Lectotype: ♂, State of Washington: no specific locality (ANSP), designated by Cresson 1928:43. As synonym of *mundus*: Pulawski *in* Krombein 1979:1632.—Dalla Torre 1897:677; G. Bohart 1951:950; Bohart and Menke 1976:272.—As *Tachysphex mundus aequalis*: Rust et al. 1985:46.

Tachysphex opwanus Rohwer, 1911:574, ♂. Holotype: ♂, Colorado: Jefferson Co., Golden (USNM). Synonymized with *aequalis* by G. Bohart 1951:950.

Tachysphex washingtoni Rohwer, 1917a:172, ♀. Holotype: ♀, Washington: Columbia River, Grand Coulee (USNM). Synonymized with *aequalis* by G. Bohart 1951:950.

Diagnosis.—*Tachysphex aequalis* closely resembles *mundus*, and both differ from the other species of the *brullii* subgroup by the characters given under *mundus* (page 169). Females of the two species differ as indicated under *mundus* (second paragraph of Diagnosis). Males of *aequalis* have black tibiae, and the distance between clypeal lip corners is equal to about 1.25 of the clypeal length (Fig. 123c) (in *mundus*, the tibiae are red, and the clypeal ratio is about 1.0).

Description.—Scutum not prominent posterolaterally, scutal punctures mostly less than one diameter apart (midscutal punctures up to two or three diameters apart mesally in some specimens). Mesopleural punctures well defined to evanescent, interspaces evenly microreticulate. Propodeal dorsum evenly microareolate; side evenly microreticulate, also punctate in some specimens. Terga densely micropunctate.

Setae suberect to erect on vertex, appressed or nearly so on mesothorax and femora; integument easily visible. Scutal setae oriented posterad. Setae length (in MOD) 0.8 on lower gena, 0.8–1.0 on vertex, 0.8–1.2 on propodeal dorsum.

Head and thorax black. Terga I–IV silvery fasciate apically. Wings weakly infumate to almost hyaline.

♀.—Labrum emarginate. Clypeal bevel longer than basomedian area; lip not broadened, with or without median notch, with two lateral incisions on each side. Dorsal length of flagellomere I 1.3–1.9 × apical width. Vertex punctures more than one diameter apart, at least mesally. Mesopleural punctures at middle two to five diameters apart (Fig. 123a, b), fine in most specimens, but rather coarse in certain individuals from Nevada and Utah. Pygidial plate with a few, sparse setae, usually broad, very rarely narrow. Tarsomere V of most specimens with one or two small spines on lateral margin. Length 7.5–10.0 mm.

Gastral segments I and II or I–III red, remainder black; all segments red in some females from Los Angeles, Orange, San Bernardino, and Santa Barbara counties, California, and in Baja California individuals. Femora and tibiae black in most specimens, but a female from Moenkopi, Arizona, has all red hindfemur and hindtibia and largely red fore- and midtibia.

♂.—Clypeal bevel shorter than basomedian area or absent; lip arcuate or slightly concave on each side; distance between lip corners equal to about 1.25 of clypeal length (Fig. 123c). Dorsal length of flagellomere I 1.1–1.4 × apical width. Vertex punctures fine, about one diameter apart. Mesopleural punctures subcontiguous to more than one diameter apart. Sterna pubescent throughout; sterna III–VI with graduli. Length 5.5–8.5 mm.

Gastral segments I and II or I–III red, remainder black (only tergum II and posterior half of sternum II red in some individuals). Femora black, tibiae all or largely black (but markedly red in one specimen from Wikieup, Arizona); tarsi red, dark basally. Frontal vestiture golden except silvery in smallest specimens.

Discussion.—I previously (Pulawski *in* Krombein 1979) synonymized *aequalis* with *mundus*, considering it a geographic population of the latter. However, no intergradation between *aequalis* and *mundus* has been observed in the large numbers of specimens studied since and I now regard *aequalis* as a valid species.

Two females from Topock, Arizona (UCD), resemble *aequalis* in having the mesopleural punctures two to three diameters apart in the middle, but gaster is all black (except with small reddish zones on the sides of tergum I in one). I cannot determine whether these specimens are melanotic *aequalis* or members of some other species, e.g., *maurus*.

Life History.—Males of *aequalis* (CIS) were collected on flowers of *Foeniculum vulgare* Mill. at Artois, California, and of *Euphorbia* at Jacalitos Canyon, California. A female and a male from Logan, Utah (USU) were collected on flowers of *Daucus carota* L.

Geographic Distribution (Fig. 124).—Southern British Columbia, United States west of the Rocky Mountains and also Black Hills National Forest area in eastern Wyoming, western Mexico south to Chiapas.

Material Examined.—505♀, 799♂.

Records.—CANADA: **British Columbia:** Mt. Robson, Vernon.

UNITED STATES: ARIZONA: **Cochise:** Ash Springs (Chiricahua Mts.), Portal (also 2 mi NE, 6 and 9 mi W). **Coconino:** 3 mi E Moenkopi. **Gila:** 3 mi SW Christmas. **Graham:** Roper Lake State Park. **Maricopa:** Wickenburg. **Mohave:** Topock, Wikieup. **Pima:** Continental, Sabino Canyon (Santa Catalina Mts.), Tucson. **Pinal:** 3 mi W Superior (Boyce Thompson Arboretum). **Santa Cruz:** Felton Springs, Madera Canyon (Santa Rita Mts.), Sycamore Canyon. **Yavapai:** Prescott. CALIFORNIA: **Alameda:** 2 mi NE Livermore, Sycamore Grove State Park. **Alpine:** Indian Creek Road (3 mi N Markleeville), Silver Creek, Woodfords. **Amador:** Plymouth. **Butte:** Oroville. **Calaveras:** Arnold, Mokell Hill. **Colusa:** Colusa. **Contra Costa. El Dorado:** 3.8 mi SW Somerset. **Fresno. Glenn:** Artois, 2 mi N Glenn, Willows. **Humboldt:** Garberville. **Inyo. Kern:** Antelope Canyon near Tehachapi, Frazier Park, Mill Potrero. **Lake:** Bartlett Spring. **Lassen:** Hallelujah Junction. **Los Angeles. Marin. Mariposa:** Mariposa. **Mendocino:** Hendy Groves State Park, 2 mi S Hopland, Navarro. **Modoc:** Cedar Pass, Davis Creek, Lake City. **Mono. Monterey. Napa:** Bitter Creek (Lake Lommel, vicinity Calistoga). **Nevada:** Nevada City. **Orange:** Corona del Mar, Peters Canyon. **Placer:** Auburn, Emigrant Gap, Weimar. **Plumas:** Lake Almanor, 6 mi E Spring Garden. **Riverside. Sacramento. San Benito:** Idria (Gem Mine). **San Bernardino:** Cajon, Mill Creek, San Bernardino Mts. (Coon Creek, Mountain Home Creek), S Fork of Santa Ana River, Wildwood Canyon (5 mi E Calimesa), 3 mi S Yucaipa. **San Diego. San Joaquin:** Tracy. **San Luis Obispo:** Dune Lakes (3 mi S Oceano), Montana de Oro State Park (3 mi SW Los Osos), Morro Bay. **San Mateo:** Menlo Park, Redwood City. **Santa Barbara:** including Santa Cruz Island. **Santa Clara:** Alum Rock Park, San Jose, Stanford University. **Santa Cruz:** Felton Springs (also 25 mi N), Lockhart Gulch (5 mi E Mt. Hermon), Santa Cruz Mts. **Shasta. Sierra:** Sierraville. **Siskiyou:** Etna, McBride Springs (3 mi NNE Mount Shasta town), Mount Shasta town. **Solano:** Benicia, Rio Vista, Vallejo. **Sonoma:** Healdsburg, Laguna de Santa Rosa, Petaluma. **Stanislaus:** Del Puerto Canyon, La Grange. **Trinity:** Junction City. **Tulare:** Lemon Cove, Three Rivers, Woodlake. **Tuolumne:** Strawberry. **Ventura. Yolo. Yuba:** 12 mi S Marysville. COLORADO: **Boulder:** Boulder. **Garfield:** Rifle. **Jefferson:** Golden. **Larimer:** Fort Collins, Glacier View Meadow (15 mi W Livermore). **Mesa:** Mack. **Montezuma:** 13 mi W Arriola. **Montrose:** Dolores Canyon. IDAHO: **Ada:** 12 mi NE Regina. **Blaine:** 3 mi W Carey. **Butte:** Craters of the Moon National Monument. **Canyon:** Notus. **Cassia:** Emery Canyon (12 mi SE Oakley), Sublette. **Elmore:** Dixie. **Franklin:** 3 mi NW Preston. **Gooding:** 1 mi NE Gooding. **Idaho:** 8 mi N Riggins. **Kootenai:** Coeur d'Alene. **Lemhi:** 3 mi N North Fork. **Lincoln:** Richfield. **Nez Perce:** Lewiston. **Oneida:** 5 mi NW Holbrook, Salyer Cow Camp, Twin Springs. **Owyhee:** 4 mi SW Bruneau, Bruneau River 20 mi N Three Creek, Hot Springs, 2 mi SW Murphy. **Payette:** 32 mi S Indian Valley. **Twin Falls:** Rock Creek Canyon (Deer Creek). MONTANA: **Sanders:** Dixon. NEVADA: **Clark:** Charleston Mts. (Willow Creek Camp). **Douglas:** 3 mi S Genoa, Minden. **Elko. Eureka:** Beowawe, 1 mi W Emigrant Pass. **Humboldt:** Orovada, Paradise Valley. **Lander:** Austin, Kingston Canyon. **Lyon:** Fernley, Smith, 5 mi N Sweetwater.

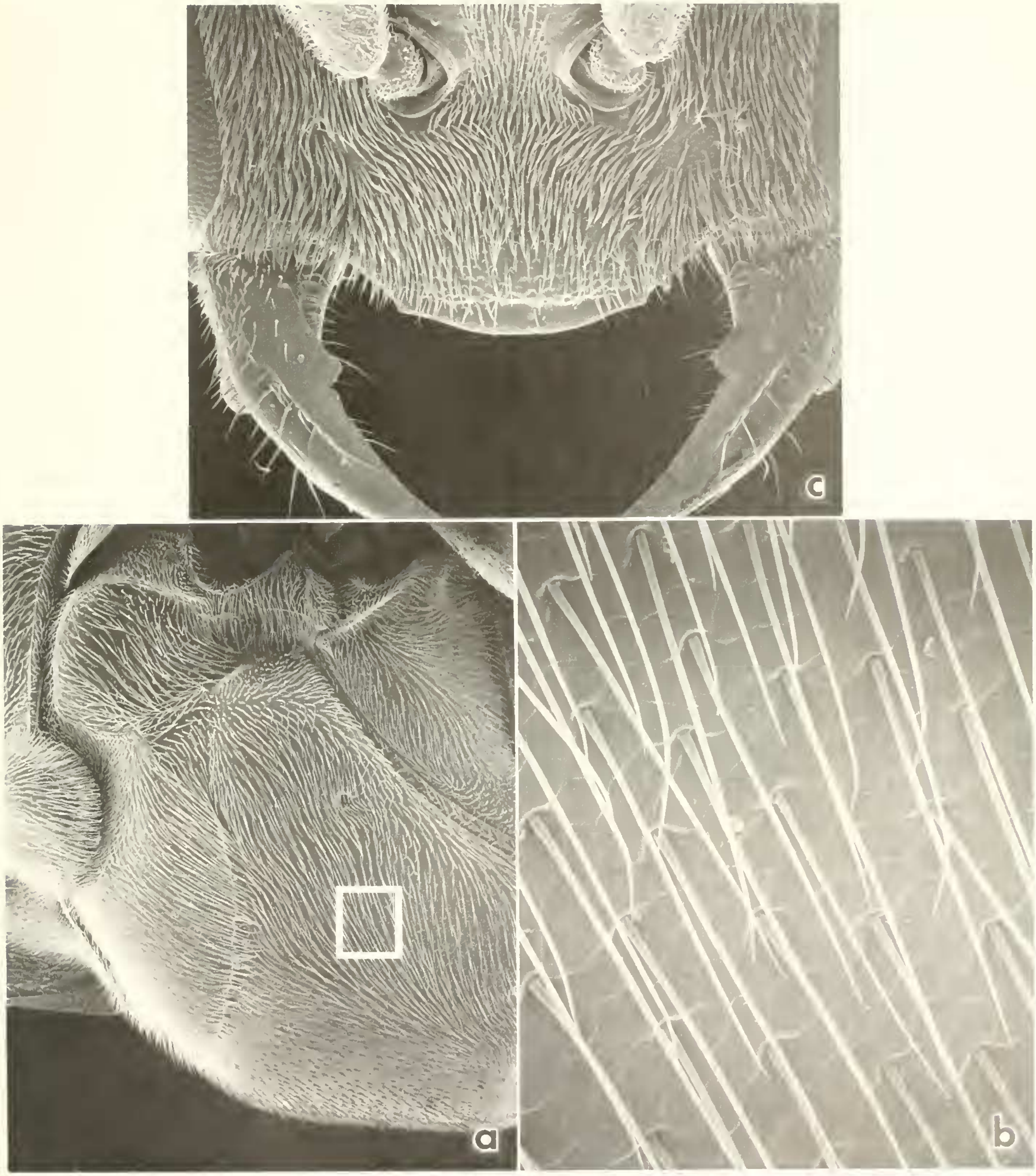

Figure 123. *Tachysphex aequalis* W. Fox: a—female mesopleuron (box: area shown in b); b—area shown in box of a; c—male clypeus.

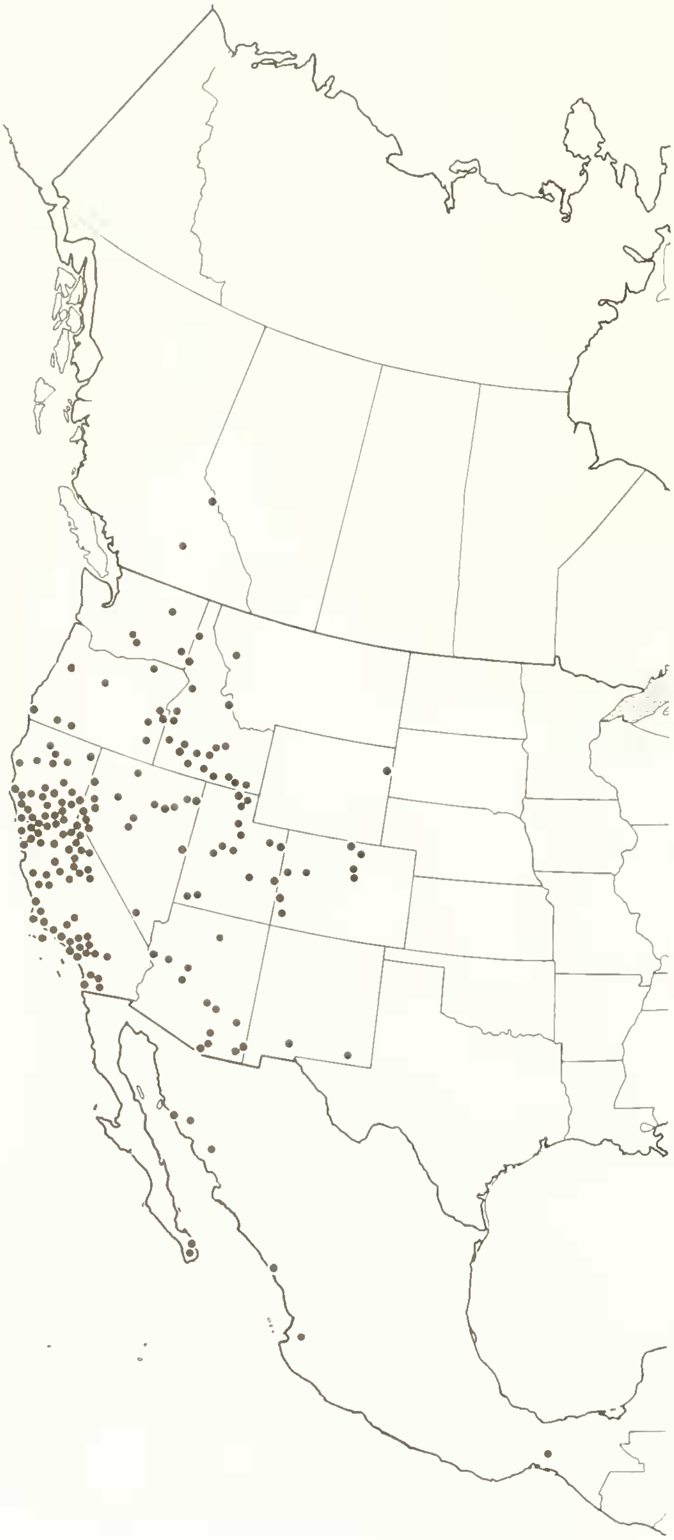

FIGURE 124. Geographic distribution of *Tachysphex aequalis* W. Fox.

Ormsby: — **Pershing:** 7 mi E Oreana. **Washoe. White Pine:** Baker. NEW MEXICO: **Dona Ana:** Las Cruces, Leasburg Dam State Park. **Eddy:** Carlsbad. OREGON: **Benton:** Corvallis. **Curry:** Gold Beach. **Deschutes:** Smith Rock State Park. **Jackson:** Brownsboro, Medford. **Klamath:** 10 mi E Dairy, 4 mi N Klamath Falls. **Malheur:** 6 mi E Burns Junction, 4 and 8 mi E Juntura, 11 mi W Ontario, 18 mi NW Vale. **Umatilla:** Pendleton. UTAH: **Box Elder. Cache. Duchesne:** Myton. **Emery:** N Goblin Valley (Buckskin Spring, Wild Horse Creek), NE Goblin Valley (3 and 4 air mi N Gilson Butte, 2 mi E Gilson Butte). **Grand:** Castleton. **Millard:** Delta, Lynndyl. **Rich:** Allen Canyon. **Salt Lake:** Salt Lake City. **Sanpete:** Moroni. **Uintah:** 17 mi S Bonanza, Gusher. **Utah:** Hobble Creek Canyon, Provo. **Washington.** WASHINGTON: **Grant:** Grand Coulee. **Whitman:** Wawawai. **Yakima:** Buena, Yakima. WYOMING: **Weston:** Newcastle.

MEXICO: **Baja California Sur:** Los Barriles, 4 mi WSW Miraflores. **Chiapas:** 28 mi W Cintalapa. **Jalisco:** Plan de Barrancas. **Sinaloa:** Presidio near Mazatlán. **Sonora:** Aduana, Cócorit, 6 km NNW San Carlos.

Tachysphex robustior Williams, revised status

(Figures 125, 126)

Tachysphex robustior Williams, 1914:164, ♂.[1] Holotype ♂: Kansas: Grant Co.: no specific locality (KU). — G. Bohart 1951:952, LaBerge 1956:527; Arnaud 1970: 33, Bohart and Menke 1976:276, Pulawski *in* Krombein 1979:1632 (as synonym of *mundus*).

Tachysphex crenuloides Williams, 1914:168, ♀.[1] Holotype ♀: Kansas: Morton Co.: no specific locality (KU). Synonymized with *robustior* by G. Bohart 1951:952. — LaBerge 1956:527; Arnaud 1970:32.

DIAGNOSIS. — Females of *robustior* can be recognized by a prominent scutal hindcorner (Fig. 125a) combined with black tibiae and a basally red gaster. Possibly some females are all black (as are some males), and such individuals could be confused with *maurus* and *utina*. However, the scutal punctures of *robustior* are less than one diameter apart, with dull interspaces, and the axilla is evenly convex. In *maurus*, midscutal punctures are more than one diameter apart or slightly less, and the interspaces are shiny. In *utina*, the axilla is steplike laterally. The male of *robustior* has a distinctive sternal feature: the setae of sterna III–V exceed the sternal hindmargin and form regular although small fasciae (Fig. 125c). Also, the combination of a basally red gaster and the prominent scutal hindcorner is distinctive for most specimens. Like *maurus* and *utina*, the frontal vestiture of *robustior* is silvery, but golden in most *aequalis* and most *mundus*.

DESCRIPTION. — Scutum shiny, prominent posterolaterally (Fig. 125a, b), but weakly so in some females; scutal punctures less than one diameter apart. Mesopleuron microsculptured and punctate, punctures of most specimens less than one diameter apart, but up to two diameters apart in a female from Big Bend National Park, Texas (UCD). Propodeal dorsum evenly microareolate; side microsculptured, with inconspicuous punctures.

Setae appressed to suberect on vertex, appressed or nearly so on scutum and femora, subappressed to suberect on mesopleuron. Scutal setae oriented posterad. Setae length (in MOD): up to 1.3 adjacent to hypostomal carina, about 0.7 on vertex, 1.0–1.3 on propodeal dorsum.

Head, thorax, and legs black, tarsal apex reddish. Frontal vestiture silvery.

♀. — Labrum emarginate. Clypeal bevel about as long as basomedian area; lip not broadened, with or without median emargination, with two lateral incisions on each side. Dorsal length of flagellomere I 1.8–2.2 × apical width. Most vertex punctures less than one diameter apart, but some punctures up to one or two diameters apart. Pygidial plate with a few, sparse setae. Tarsomere V without spines on venter or lateral margins. Length 6–8 mm.

Gaster all red, or segments IV–VI or III–VI black (females from Port Isabel, Matamoros, and some from Fedor, Texas), or gaster predominantly black, with translucent apical depression and narrow reddish zones (a female from Jiménez area, Mexico).

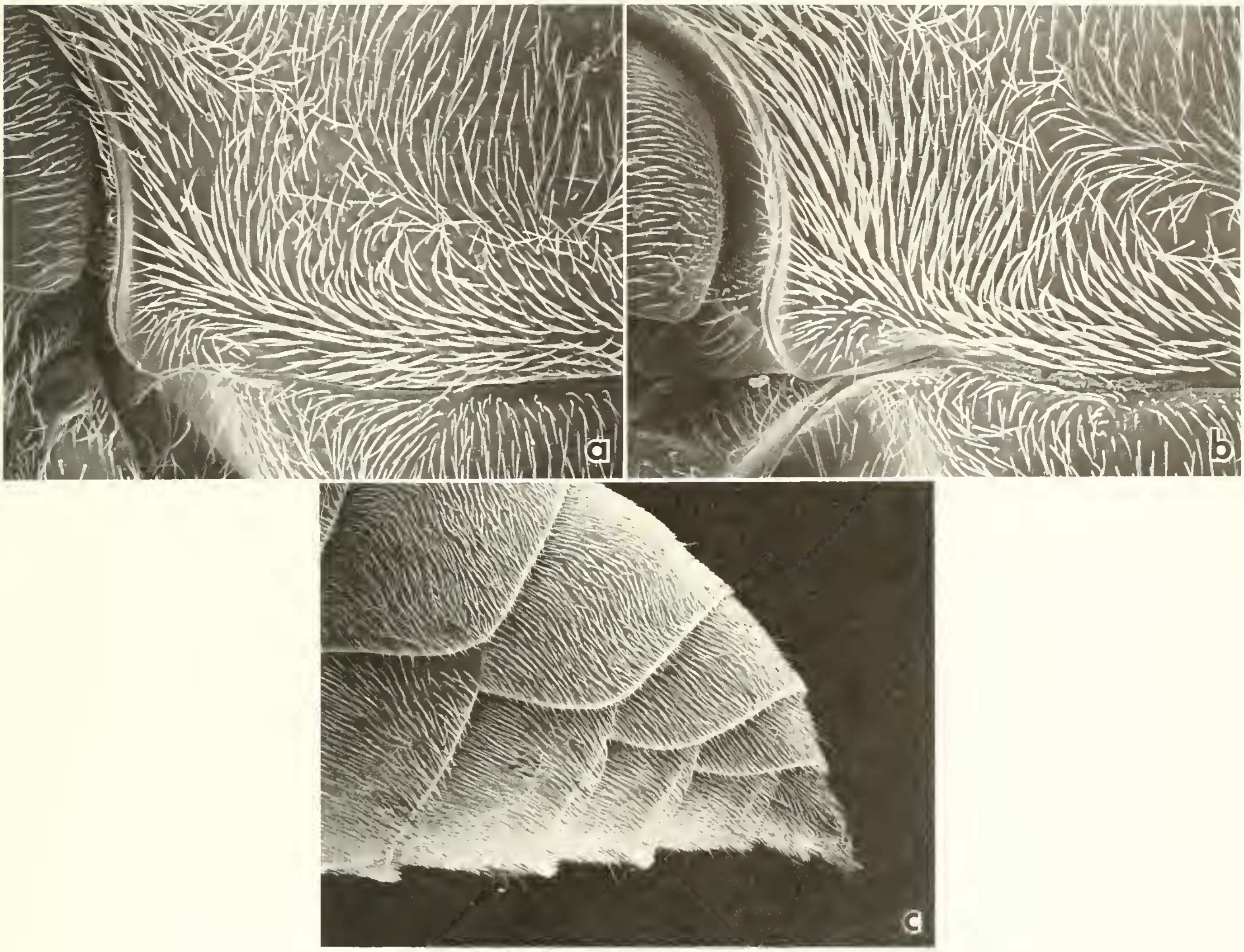

FIGURE 125. *Tachysphex robustior* Williams: a—scutal hindcorner of female; b—scutal hindcorner of male; c—gastral apex of male.

♂.—Clypeal bevel shorter than basomedian area; lip arcuate, distance between its corners about equal to clypeal length. Dorsal length of flagellomere I about 1.2× apical width. Vertex punctures less than one diameter apart in some individuals, one to two diameters apart in others. Sterna pubescent throughout, setae of sterna III–V forming apical fasciae that extent beyond sternal hindmargin (Fig. 125c). Sterna III–VI with graduli. Length 5.5–7.0 mm.

Gastral segments I and II or I–III red in most specimens, but gaster all black in a male from San Carlos, Sonora (UCD).

DISCUSSION.—I previously synonymized (Pulawski *in* Krombein 1979) *robustior* with *mundus* because only chromatic differences between the two were known to me. These differences seemed no more significant than those between the two color phases of *mundus* (*mundus mundus* and *mundus exsectus*). However, the distinctive sternal fasciae in the male of *robustior* demonstrate that it is a valid species. The structure is unique, and no intermediates have been observed. The prominent scutal hindcorner is also significant.

GEOGRAPHIC DISTRIBUTION (Fig. 126).—Arizona to southeastern Texas, north to Colorado and Kansas, south to Sonora, Chihuahua, and Tamaulipas states in Mexico.

MATERIAL EXAMINED.—51♀, 54♂ (CAS, CNC, CSDA, CSU, FSCA, MCZ, NYSU, TAI, UAT, UCD, USNM, USU).

RECORDS.—UNITED STATES: ARIZONA: **Cochise:** Hereford, Portal. **Pima:** Continental, Saguaro National Monument, Tucson. COLORADO: **Bent:** 2 mi S Hasty. KANSAS: **Grant, Morton, Reno:** —. **Kearny:** Lakin. NEW MEXICO: **Luna:** Columbus. TEXAS: **Brewster:** Big Bend National Park (Nine Point Draw, Santa Elena Canyon). **Cameron:** Port Isabel. **Culberson:** Pine Springs. **Hudspeth:** Salt Flat. **Kleberg:** Baffin Bay 6 mi E Riviera (=20 mi SE Kingsville). **Lee:** Fedor. **Maverick:** Quemado. **San Patricio:** Welder Wildlife Refuge (7 mi NE Sinton).

MEXICO: **Chihuahua:** 18 mi W Jiménez. **Coahuila:** 19 km W Cuatrociénegas. **Sonora:** San Carlos. **Tamaulipas:** Matamoros (also 30 mi SE), Playa Altamira, Rio Corona 18 mi N Ciudad Victoria.

Tachysphex maurus Rohwer

(Figure 127)

Tachysphex maurus Rohwer, 1911:575, ♀, ♂.[1] Lectotype: ♂, Texas, Lee Co., Fedor (USNM), present designation.—G. Bohart 1951:951, Bohart and Menke 1976: 274. Krombein 1979:1632.

DIAGNOSIS.—*Tachysphex maurus* is an all black species with a prominent scutal hindcorner (see Fig. 125a, b), a combination also found in *utina* and some *robustior*. However, the midscutal punctures of *maurus* average more than one diameter apart (slightly less than one diameter apart in some males), and the

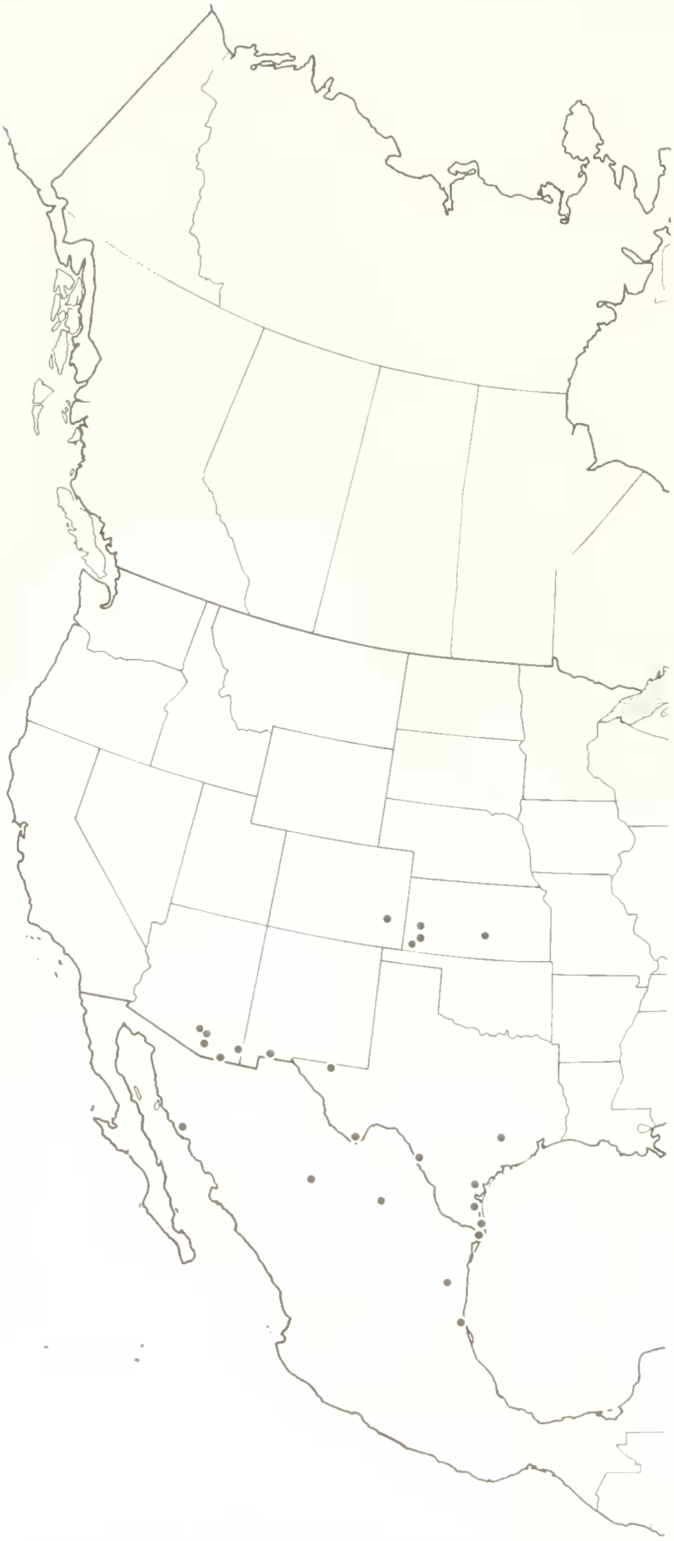

FIGURE 126. Geographic distribution of *Tachysphex robustior* Williams.

interspaces are shiny. In the other two species, the midscutal punctures are less than one diameter apart, and the interspaces are dull. Unlike *utina*, the axilla of *maurus* is not steplike laterally. Unlike *robustior*, male sterna of *maurus* are not fasciate apically. Many females of *mundus* are also all black, but they have a rounded scutal hindcorner (Fig. 120e), and their midscutal punctures are less than one diameter apart.

DESCRIPTION.—Scutum shiny, prominent posterolaterally (weakly so in female); midscutal punctures averaging more than one diameter apart, except slightly less than one diameter apart in some males. Mesopleuron weakly microsculptured, shiny, with well-defined punctures that are one to two diameters apart at middle. Propodeal dorsum evenly microreticulate or (some males) weakly rugose; side punctate or (some males) rugose.

Setae suberect to erect on vertex, appressed or nearly so on mesothorax and femora. Scutal setae oriented posterad. Setae length (in MOD): 0.8 along hypostomal carina, 0.8–1.0 on vertex, 0.8–1.2 on propodeal dorsum.

Head, thorax, and gaster black; legs black, tarsal apex brown, tibiae of some males partly brown. Frontal vestiture silvery.

♀.—Labrum emarginate. Clypeal bevel longer than basomedian area; lip not broadened, with or without mesal notch, with two lateral incisions on each side. Dorsal length of flagellomere I 1.4–1.8 × apical width. Punctures more than one diameter apart on vertex (at least mesially). Pygidial plate broad, with few, sparse setae. Tarsomeres V without spines on venter or lateral margins. Length 7–11 mm.

♂.—Clypeal bevel shorter than basomedian area or absent; lip arcuate, distance between corners varying from about one (most specimens) to about 1.25 of clypeal length. Dorsal length of flagellomere I 1.1–1.3 × apical width. Vertex punctures fine, about one diameter apart. Sterna pubescent throughout, but without setal fasciae at hindmargins; sterna III–VI with graduli. Length 4.8–8.0 mm. Penis valve as in *mundus*.

GEOGRAPHIC DISTRIBUTION (Fig. 127).—Southern Oklahoma, Texas, Arizona, Mexico, south to Costa Rica.

MATERIAL EXAMINED.—49♀, 86♂ (AMNH, CAS, CIS, CSDA, CU, FSCA, KU, NYSU, MCZ, TAI, UAT, UCD, USNM, USU).

RECORDS.—UNITED STATES: ARIZONA: **Cochise:** 5 and 13 mi SE Apache (also 11 mi S), 28 mi N Douglas, Miller Canyon (Huachuca Mts.), Portal. **Graham:** Roper Lake State Park (7 mi S Safford). **Pima:** Molino Basin (Santa Catalina Mts.), Tucson. **Pinal:** Coolidge. **Santa Cruz:** Nogales (also 5 mi E), Sycamore Canyon (Ruby Road), Walker Canyon (6 mi NW Nogales). NEW MEXICO: **Dona Ana:** Leasburg Dam State Park. OKLAHOMA: **Marshall:** Lake Texoma (2 mi E Willis). TEXAS: **Atascosa:** Pleasanton. **Bastrop:** 6 mi E Bastrop. **Bosque:** —. **Caldwell:** Luling. **Dallas:** Dallas. **Duval:** 18 mi N San Diego. **Hidalgo:** Bentsen Rio Grande Valley State Park. **Kimble:** Junction. **Kleberg:** Baffin Bay 20 mi SE Kingsville. **Lee:** Fedor. **Uvalde:** Nueces River 12 mi S Uvalde, 30 mi N Uvalde.

MEXICO: **Chihuahua:** 10 mi N Chihuahua. **Colima:** 23 mi N Manzanillo. **Guerrero:** Acapulco. **Jalisco:** Chamela. **Morelos:** 5 mi E Cuernavaca. **Nayarit:** Jesus Maria. **Oaxaca:** 23 mi S Matias Romero. **Sinaloa:** 6 mi NW Choix, 34 mi N Los Mochis, 2.5 and 5 mi N Mazatlan. **Sonora:** Alamos (also 10 mi SE), Magdalena, 28 mi S Navajoa, Nogales, San Carlos, E of Yaqui River (35 air km WSW Sahuaripa). *Zacatecas:* San Juan Capistrano (22°38′N, 104°05′W).

CENTRAL AMERICA: COSTA RICA: Junquillal Beach (Guanacaste Prov.).

Tachysphex utina sp. n.

(Figure 127)

DERIVATION OF NAME.—Utina is a Florida Indian name that probably refers to the chief and means powerful; noun in apposition.

DIAGNOSIS.—*Tachysphex utina* has an all black body and a prominent scutal hindcorner (see Fig. 125a, b), a combination also found in *maurus* and some *robustior*. In *utina*, the axilla is steplike (only weakly so in the female), the scutal punctures are less than one diameter apart, with dull interspaces, and male sterna are not fasciate apically. In the other two species, the axilla is gradually sloping laterad. In addition, scutal punctures

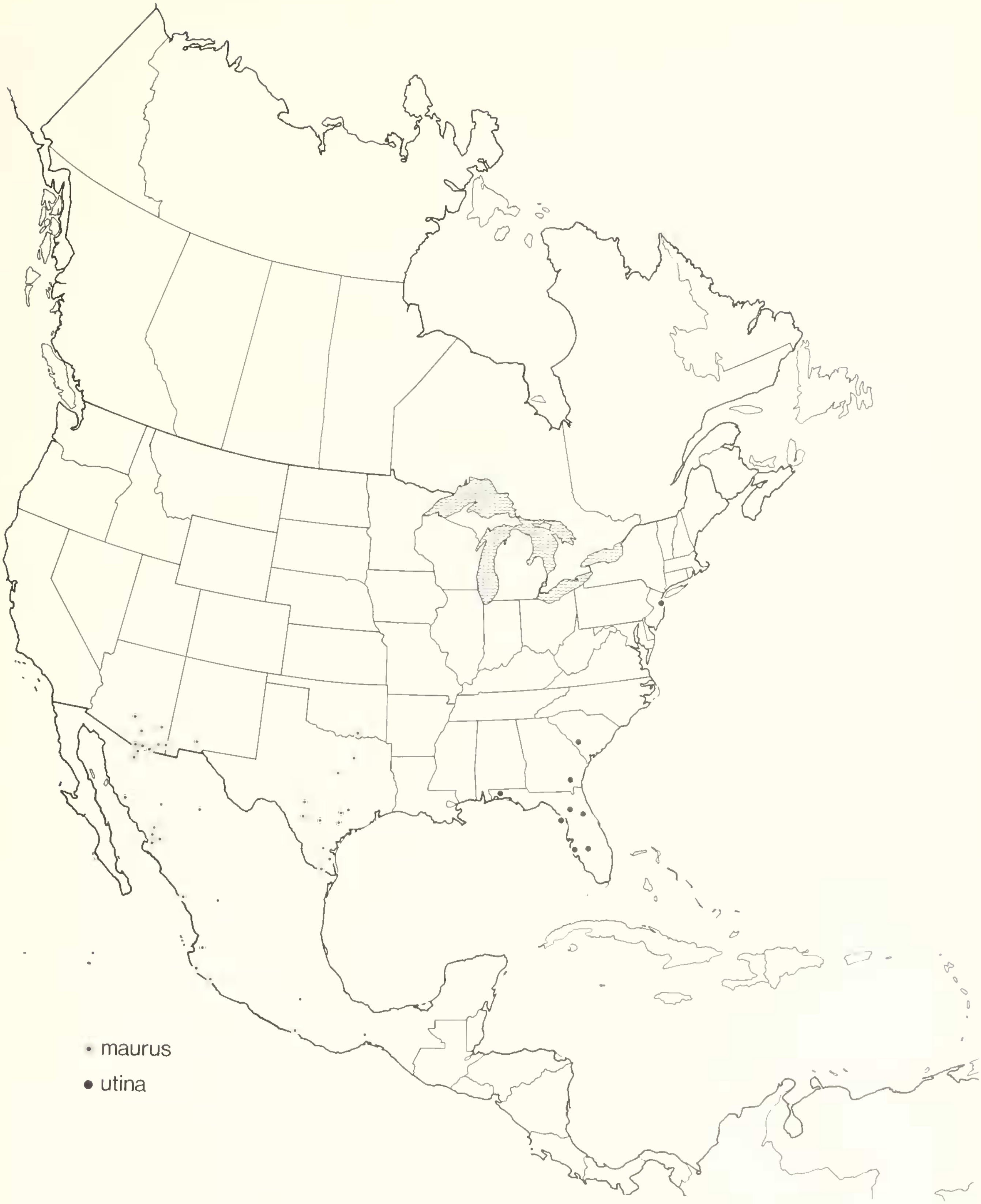

FIGURE 127. Geographic distribution of *Tachysphex maurus* Rohwer and *utina* sp. n.

of most *maurus* average more than one diameter apart (slightly less than one diameter in some males), and the interspaces are shiny; and in *robustior*, male sterna III–V are fasciate apically (Fig. 125e). Geographic distribution also aids identification: *utina* occurs along the Atlantic Coast between New Jersey and Florida, while *maurus* and *robustior* are found west of the Mississippi River.

Description. — Vertex punctures one to two diameters apart. Scutum weakly shiny, prominent posterolaterally (weakly so in female). Axilla peculiar, steplike, overhanging sloping (lateral) part. Mesopleuron microsculptured, with minute punctures that are more than one diameter apart. Propodeal dorsum evenly microareolate; side microsculptured, with inconspicuous punctures.

Setae suberect on vertex, appressed on scutum and femora; suberect on mesopleuron. Scutal setae oriented posterad. Setae length (in MOD): 0.7–1.0 adjacent to hypostomal carina, about 0.7 on vertex, 1.0–1.3 on propodeal dorsum.

Head, thorax, gaster, and legs black. Frontal vestiture silvery. Wings weakly infumate.

♀. — Labrum emarginate. Clypeal bevel about as long as basomedian area; lip not broadened, mesally entire or emarginate, with two lateral incisions on each side. Dorsal length of flagellomere I 1.6–1.7 × apical width. Midscutal punctures averaging less than one diameter apart. Axilla sloping more steeply laterad than in *mundus*. Pygidial plate with few, sparse setae. Tarsomere V without spines on venter or lateral margins. Length 7–8 mm.

♂. — Clypeal bevel absent; lip arcuate, distance between its corners about equal clypeal length. Dorsal length of flagellomere I about 1.3–1.4 × apical width. Midscutal punctures averaging about one diameter apart. Axilla peculiar, sloping almost vertically laterad. Sterna densely pubescent, but without setal fasciae apically. Sterna III–VI with graduli. Length 6.0–6.3 mm.

Discussion. — *Tachysphex utina* and *maurus* are very similar morphologically. They are allopatric and thus they may be geographic forms of one species. However, intermediates have not been seen.

Geographic Distribution (Fig. 127). — New Jersey to Florida.

Collecting Period. — 14 April (Florida) through 31 July (New Jersey).

Material Examined. — Holotype ♀, Florida: Putnam: Welaka, 1–4 May 1955, HEE and M. A. Evans (USNM).

Paratypes (14♂, 9♀). UNITED STATES: FLORIDA: **Alachua:** Gainesville, 17 May 1976, W. H. Pierce (1♂, UCD); 14–19 May 1976 (Austin Carey Memorial Forest), G. B. Fairchild (1♀, FSCA); 16–20 July 1975, EEG (1♂, FSCA). **Highlands:** Archbold Biological Station, 14 Apr 1968, J. G. and B. L. Rozen (1♂, AMNH); 8 and 31 May 1981, F. L. Lampert (2♂, CAS, FSCA). **Levy:** Cedar Key, 18 May 1970, D. L. Bailey (2♀, CAS, USNM). **Okaloosa:** 4.5 mi N Holt, 17 June 1978, LAS (1♂, 1♀, FSCA). **Putnam:** Georgetown, 30 Apr 1955, HEE and M. A. Evans (1♂, head missing, MCZ); Welaka, same data as holotype (1♀ MCZ, 1♂, 1♀, USNM). **Sarasota:** ocean beach, 3 June 1954, H. V. Weems (1♂, FSCA). GEORGIA: **Ware:** 8.2 mi N Waycross, 18 July 1969, N. Burdick (1♀, CAS, 1♂, 1♀ NYSU). NEW JERSEY: **Monmouth:** Little Silver, 31 July 1979, A. Hook (2♂, CAS, CSU). SOUTH CAROLINA: **Aiken:** Aiken, 23 June 1957, W. R. M. Mason (1♀, CAS; 1♂, 1♀, CNC).

Tachysphex belfragei (Cresson)

(Figures 128–130)

Larra Belfragei Cresson, 1872:215, ♀ (incorrect original spelling) ! Holotype ♀, Texas: Bosque Co.: no specific locality (USNM). — Patton 1881:389, Kohl 1885: 242, Cresson 1916:95. — In *Tachysphex*: W. Fox 1894*a*:509, Dalla Torre 1897: 678 (as *belfragii*), Ashmead 1899:250; H. Smith 1908:381, Williams 1914:164, Mickel 1918:421, Robertson 1928:121, 128, 163, 199, 203, G. Bohart 1951: 950; Krombein 1958*c*:188, 1967:392, Bohart and Menke 1976:272, Krombein 1979:1632.

Tachytes minimus W. Fox, 1892:248, ♂. ! Lectotype: ♂, Texas: no specific locality (ANSP), designated by Cresson 1928:45. Synonymized by R. Bohart *in* Bohart and Menke 1976:272. — In *Tachysphex*: W. Fox 1894*a*:532; Dalla Torre 1897: 681, Ashmead 1899:250, J. Smith 1900:518, H. Smith 1908:381, J. Smith 1910: 683, Williams 1914:173, Mickel 1918:421, Brimley 1938:443, Krombein 1939: 139, G. Bohart 1951:951, Krombein and Evans 1954:232, 1955:231, Kurczewski 1971:114 (in key).

Diagnosis. — The coarsely sculptured propodeal dorsum (Fig. 128b), or finely rugose in many males, separates *belfragei* from all other New World species of the *brullii* subgroup. The female also differs from other species except *krombeiniellus* in having a mesally expanded clypeal lip (Fig. 128a) and an apically biemarginate basal platform of sternum II (Fig. 128e).

Description. — Mesothoracic punctures subcontiguous, somewhat ill defined on mesopleuron (where the integument is dull). Scutum rounded posterolaterally. Propodeal dorsum coarsely, irregularly rugose (Fig. 128b), but finely rugose in many males; side ridged. Terga densely micropunctate.

Setae appressed on vertex, mesothorax, and femora; underlying integument easily visible. Scutal setae oriented posterad.

Femora black (except red apically), tibiae and tarsi red. Terga I–IV (I–V in some males) silvery fasciate apically. Wings yellowish.

♀. — Labrum emarginate mesally. Clypeal bevel shorter to longer than basomedian area; lip broadened mesally, emarginate mesally in nearly all specimens, with two lateral incisions on each side (Fig. 128a). Dorsal length of flagellomere I 1.6–1.9 × apical width. Vertex punctures less than one diameter apart, in many specimens more than one diameter apart near orbits. Basal platform of sternum II with biemarginate apical margin. Pygidial plate narrow, densely setose apically (Fig. 128d). Tarsomere V without spines on venter and lateral margins. Length 7.5–11.0 mm.

Setae length about 1.0–1.2 MOD along hypostomal carina and on propodeal dorsum.

Gastral segments I and II or I–III red, remainder black.

♂. — Clypeal bevel convex, shiny, shorter than basomedian area; lip broadly arcuate, corners indistinct and obtuse or prominent and rectangular, separated by a distance that is about equal to clypeal length. Dorsal length of flagellomere I 1.2–1.6 × apical width. Vertex with fine, well-defined punctures that are less than one diameter apart. Sterna densely punctate and pubescent, but without setal fasciae on hindmargins; sterna III–VI with graduli. Length 6.5–7.5 mm. Penis valve: Figure 129.

Setae length 0.6–0.8 MOD along hypostomal carina and on propodeal dorsum.

Gaster black or segments I and II partly red. Frontal vestiture silvery or with golden tinge.

Life History. — H. Smith (1908) observed *belfragei* on flowers of *Euphorbia*, Mickel (1917) on flowers of *Chamaecrista fasciculata* (Michx.) Greene, and Robertson (1928) on flowers of *Chamaecrista fasciculata* (Michx.) Greene (as *Cassia chamaecristata* (L.)), *Ceanothus americanus* L., *Cicuta maculata* L., *Eryngium yuccifolium* Michx., *Oxypolis rigidior* (L.) C. and R., and *Pycnanthemum flexuosum* (Walt.) B.S.P. The species preys upon nymphs of *Conocephalus* sp., a tettigoniid (Krombein 1967). Kurczewski (1979) observed a female transporting a nymph of *Conocephalus* on the ground. She held the prey's

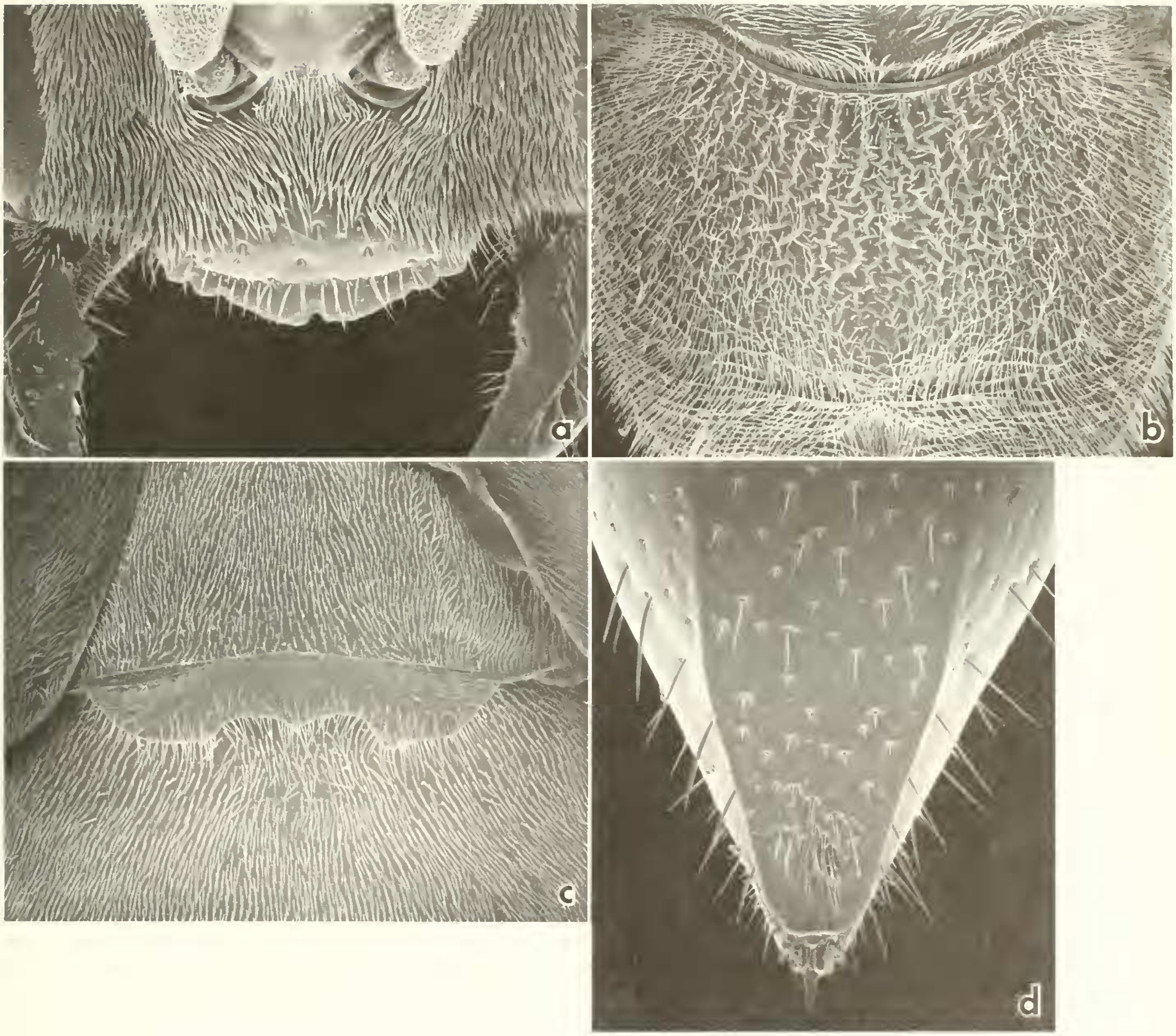

FIGURE 128. *Tachysphex belfragei* (Cresson), female: a—clypeus; b—propodeal dorsum; c—apex of sternum I and base of sternum II, d—pygidial plate.

antennae with her mandibles. The prey was carried directly into the nest (Kurczewski did not say it explicitly, but this description suggests that the nest is permanently open during the provisioning period). The cell was stocked with four prey, and an egg was placed "across the throat" of one of them. The nest was nearly vertical, 10 cm deep.

GEOGRAPHIC DISTRIBUTION (Fig. 130).—Eastern United States (except Florida) west to 100th meridian, north to Virginia and Wisconsin.

MATERIAL EXAMINED.—70♀, 33♂ (CNC, CU, FMNH, INHS, ISU, KU, MCZ, MPM, UAF, UCD, UGA, UMMZ, UMSP, USNM).

RECORDS.—UNITED STATES: ARKANSAS: **Benton, Crawford, Washington:** —. DISTRICT OF COLUMBIA: Washington. GEORGIA: **Clarke:** Athens. ILLINOIS: **Champaign:** Urbana. **Kankakee:** Kankakee. **Macoupin:** Carlinville. **Morgan:** Jacksonville. IOWA: **Woodhury:** Sioux City. KANSAS: **Barton, Dickinson:** —. **Douglas:** 4 mi W Baldwin, Lawrence. **Pottawatomie:** Little Gobi. LOUISIANA: **St. Landry:** Opelousas. MISSOURI: **Barry:** Eagle Rock. **Boone:** Columbia. **Henry:** Clinton. **St. Louis:** St. Louis. NEBRASKA: **Holt:** Goose Lake. **Lancaster:** Lincoln. NORTH CAROLINA: **Durham:** Durham. **Wake:** Raleigh. SOUTH CAROLINA: **Pickens:** Clemson. TEXAS: **Bexar:** San Antonio. **Bosque:** —. **Hall:** 3 air mi W Estelline. **Kimble:** Junction. **Kleberg:** Baffin Bay 20 mi SE Kingsville. **Lee:** Fedor. **San Patricio:** 5 mi N Sinton. VIRGINIA: Shenandoah National Park. WISCONSIN: **Grant:** Wisconsin.

Tachysphex krombeiniellus Pulawski

(Figures 131, 132)

Tachysphex krombeiniellus Pulawski, 1982:41, ♀, ♂. ! Holotype: ♀, Florida: Levy Co., no specific locality (USNM).—Noonan 1984:6.

DIAGNOSIS.—*Tachysphex krombeiniellus* has a basally red gaster and red tibiae, and its thoracic vestiture is short and does not obscure the integument (these characteristics are shared with *belfragei*, some females of *aequalis*, and many males of *mundus*). The evenly microareolate propodeal dorsum separates it from *belfragei* (in which the propodeal dorsum is rugose). In the fe-

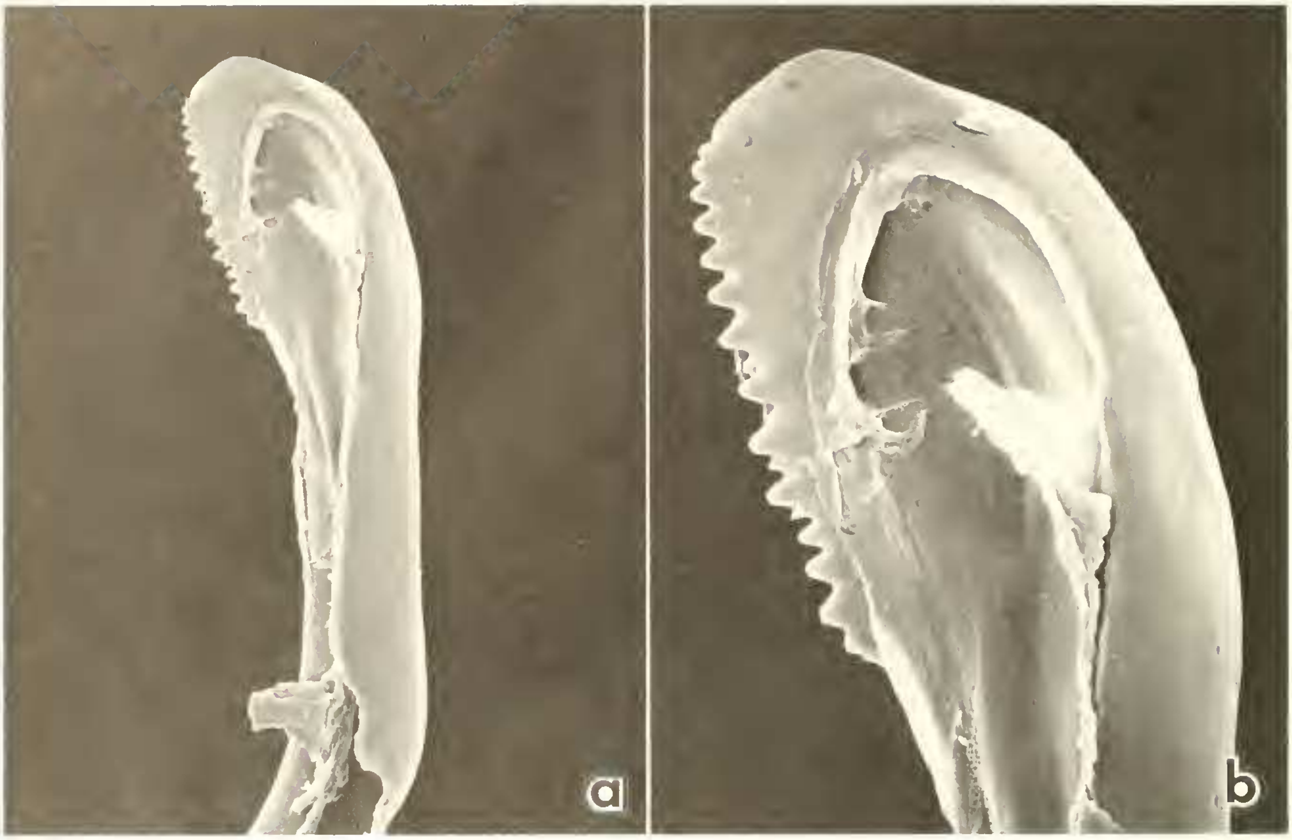

FIGURE 129. *Tachysphex belfragei* (Cresson): a—penis valve; b—same, apex

male, the mesally expanded clypeal lip (see Fig. 128a) separates *krombeinellus* from *aequalis* (and also the other species of the group except *belfragei*). In the male, the hindfemur is red in the apical third, the mesothoracic vestiture is golden or has a golden tinge, the vertex setae are appressed, and the apical (broad) portion of the penis valve is elongate (Fig. 131) (in *mundus*, the hindfemur is black, the mesothoracic vestiture is silvery, the vertex setae are erect or inclined, at least partly, and the apical portion of the penis valve is short, Fig. 121g, h).

DESCRIPTION.—Mesothorax evenly, minutely punctate, punctures subcontiguous; mesopleural punctures shallow, indistinct. Scutum roundly prominent posterolaterally. Propodeal dorsum evenly microareolate; side microsculptured, partly ridged in some specimens. Terga densely micropunctate.

Setae appressed on vertex, meosthorax, and femora, integument easily visible. Scutal setae oriented posterad.

Terga I–IV silvery fasciate apically. Tibiae and tarsi red. Wings weakly infumate.

♀.—Labrum with small, median notch. Clypeal bevel equal to basomedian area or slightly shorter; lip broadened mesally, emarginate mesally, with one or two lateral incisions on each side. Dorsal length of flagellomere I 1.8–2.0× apical width. Vertex punctures less than one diameter apart. Basal platform of sternum II straight or biemarginate apically. Pygidial plate narrow, densely setose apically. Tarsomere V without spines on venter or margins. Length 9–10 mm.

Setae length about 1.0 MOD along hypostomal carina and on propodeal dorsum.

Gastral segments I and II red, remainder black. Forefemur black (except apically) or red on apical third; mid- and hindfemur black (except on apical third) or red.

♂.—Clypeal bevel almost flat, shorter than basomedian area; lip broadly arcuate, distance between its corners equal to 0.9–1.0 of clypeal length. Dorsal length of flagellomere I 1.2–1.6× apical width. Vertex punctures fine, subcontiguous. Sterna densely punctate and pubescent throughout, but not fasciate apically; sterna III–VI with graduli. Length 7–10 mm. Penis valve: Figure 131.

Setae length about 0.5 MOD along hypostomal carina, 0.5–1.0 MOD on propodeal dorsum.

Tergum I red (except basally), usually also segment II; remainder black. Femora black, red apically (hindfemur red on apical third). Frontal vestiture golden or with golden tinge.

LIFE HISTORY.—Two females from Lincoln, Nebraska (UNL), were collected on flowers of *Solidago missouriensis* Nutt. (=*S. glaberrima* Martens).

GEOGRAPHIC DISTRIBUTION (Fig. 132).—Mainly central United States between southern Texas and North Dakota, west to 105th meridian, but also South Carolina, Arkansas, and Florida.

MATERIAL EXAMINED.—48♂, 27♀ (CAS, CIS, CU, FSCA, INHS, KU, MCZ, MPM, NYSU, UCD, UFG, UGA, UMSP, UNL, USNM).

RECORDS.—UNITED STATES. ARKANSAS: **Mississippi:** —. COLORADO: **Yuma:** Yuma. FLORIDA: **Alachua:** junction of roads 225 and 340, Monteoca (11 mi NW Gainesville). **Gadsden:** Quincy. **Leon:** Tall Timbers Research Station. **Levy:** —. KANSAS: **Graham:** Hill City. **Pottawatomie:** Blackjack. **Reno:** Hutchinson. MINNESOTA: **Goodhue:** Cannon Falls. **Scott:** Barden (between Savage and

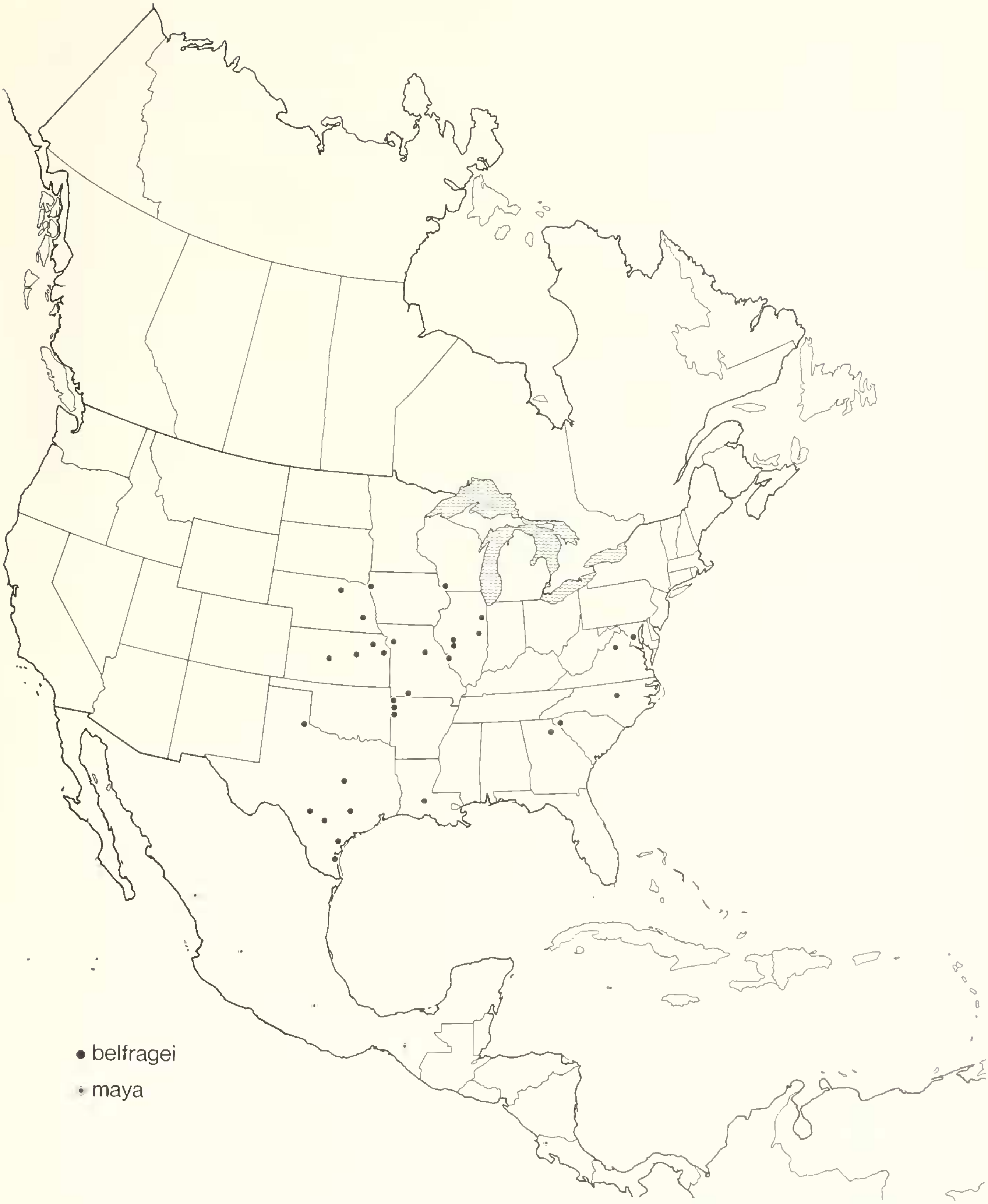

FIGURE 130. Geographic distribution of *Tachysphex belfragei* (Cresson) and *maya* sp. n.

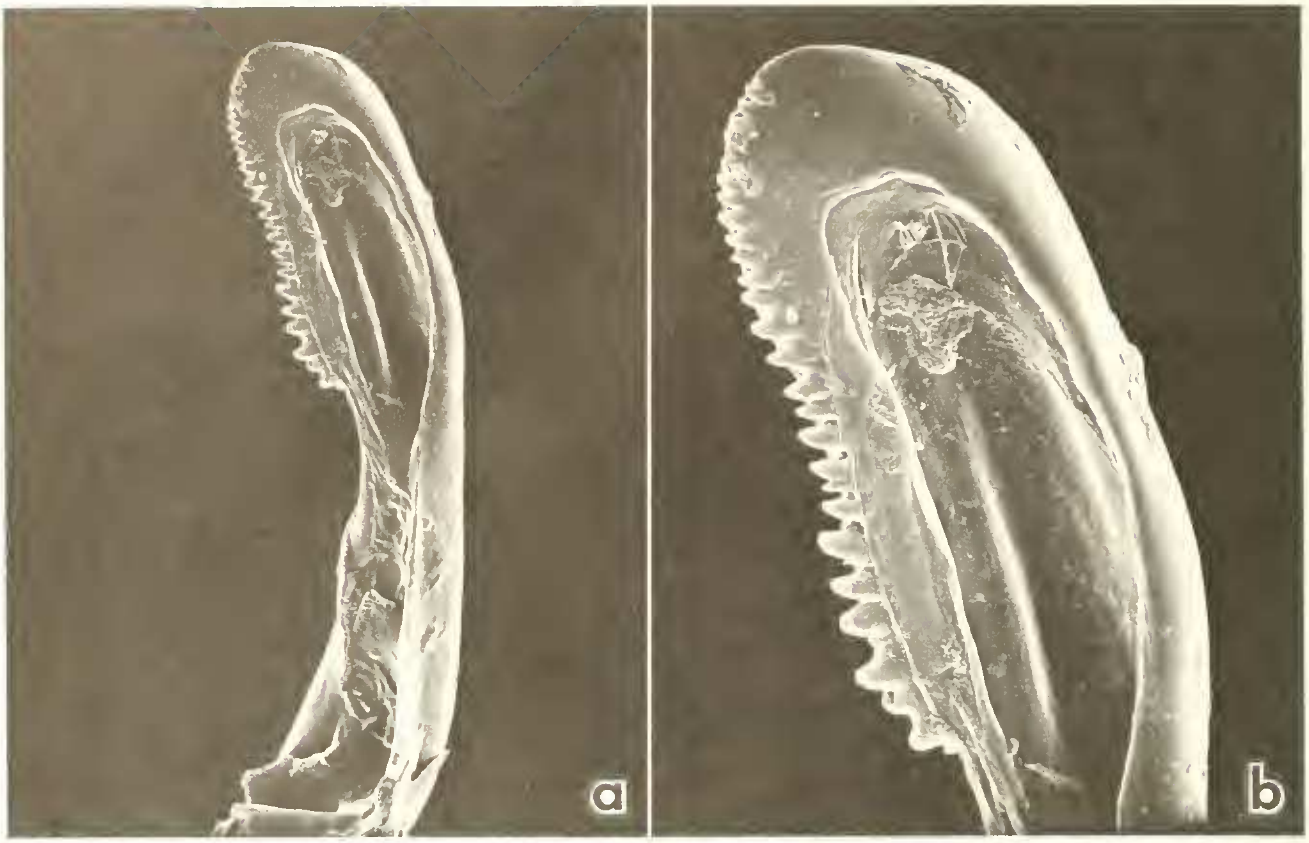

FIGURE 131. *Tachysphex krombeinellus* Pulawski: a—penis valve; b—same, apical portion.

Shakopee). NEBRASKA: **Blaine:** Halsey, Dunning. **Box Butte:** Alliance. **Dawson:** Gothenburg. **Douglas:** Omaha. **Hall:** 6 mi W Cairo. **Keith:** Ogallala. **Lancaster:** Lincoln. **Lincoln:** North Platte. **Nance:** Genoa. **Thomas:** Thedford. NORTH DAKOTA: **Ransom:** 7 mi SE Sheldon. **Richland:** 11 mi W Walcott. SOUTH CAROLINA: **Aiken:** New Ellenton. SOUTH DAKOTA: **Bennett:** 24 mi E Martin. **Todd:** 20 mi S Mission. TEXAS: **Atascosa:** Pleasanton. **Jim Hogg:** 7 mi S Hebbronville. **Kleberg:** Baffin Bay 20 mi SE Kingsville. **Potter:** 5 mi N Amarillo. WISCONSIN: **Vernon:** Genoa.

Tachysphex menkei Pulawski

(Figures 133–134)

Tachysphex menkei Pulawski, 1982:41, ♀, ♂. Holotype: ♀, California: San Diego Co.: Borrego Valley (UCD).

DIAGNOSIS.—*Tachysphex menkei* can be easily recognized by the woolly setae of the head and thorax (Fig. 133b); the finely, sparsely punctate scutum, scutellum, mesopleuron, and propodeal side; the largely impunctate, red gaster; and the glabrous male sterna III–VI.

DESCRIPTION.—Midscutal and mesopleural punctures fine, many diameters apart, interspaces aciculate. Scutal hindcorner rounded, not prominent. Propodeal dorsum opaque, evenly microareolate (indistinctly in some specimens); side weakly shiny, in most specimens with minute punctures that are several diameters apart.

Mesopleural and femoral vestitures suberect, integument easily visible. Scutal setae oriented posterad.

Terga I–III (I–IV in some males) silvery fasciate apically; fasciae weak in female.

♀.—Labrum shallowly emarginate. Clypeus (Fig. 133a): bevel equal to basomedian area or much longer; lip not emarginate or with rudimentary emargination mesally, with one or two lateral incisions on each side. Dorsal length of flagellomere I 2.1–2.5 × apical width. Vertex punctures fine, more than one diameter apart. Terga II–V without micropunctures (except laterally). Pygidial plate moderately broad. Tarsomere V without spines on venter and margins. Length 9.0–10.5 mm.

Erect setae of head and thorax woolly (Fig. 133b); setae length (in MOD): 1.0–1.2 on vertex, 2.5–3.0 along hypostomal carina, 2.0–2.5 anterolaterally on scutum, 1.6–1.8 on propodeal dorsum, and 1.2–1.6 on midfemoral venter.

Gaster red. Femora black or hindfemur largely red; tibiae black or largely red (including inner side of foretibia); tarsi red.

♂.—Clypeus (Fig. 133c): bevel convex, shiny, equal to basomedian area or shorter; lip almost straight, with rectangular or obtuse corner. Dorsal length of flagellomere I 1.5–1.9 × apical width. Vertex punctures fine, well defined, one to four diameters apart. Terga III–V without micropunctures (except basally in some specimens); sterna III–VI impunctate, glabrous (at least mesally), without graduli or transverse sulcus, not fasciate apically. Length 5.5–10.0 mm.

Erect setae along hypostomal carina and on thorax woolly (only weakly so in smallest specimens); setae length (in MOD): 1.0–1.2 on vertex, 1.6–2.5 along hypostomal carina and anterolaterally on scutum, 1.4–2.0 on propodeal dorsum, 1.0 in midfemoral venter. Apical depression of terga IV and V glabrous.

Gaster red, but tergum I black basally; apical terga brownish

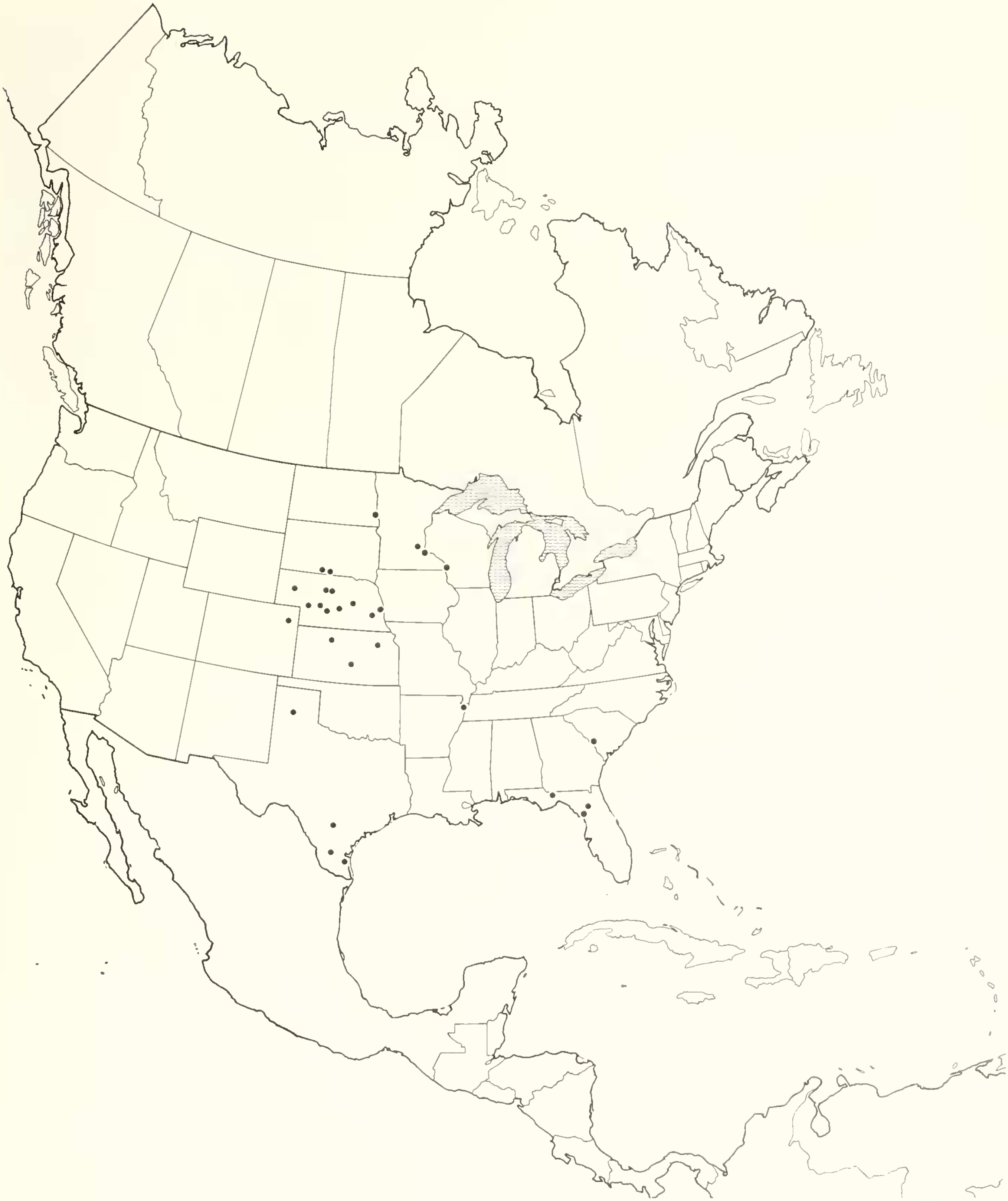

FIGURE 132. Geographic distribution of *Tachysphex krombeiniellus* Pulawski.

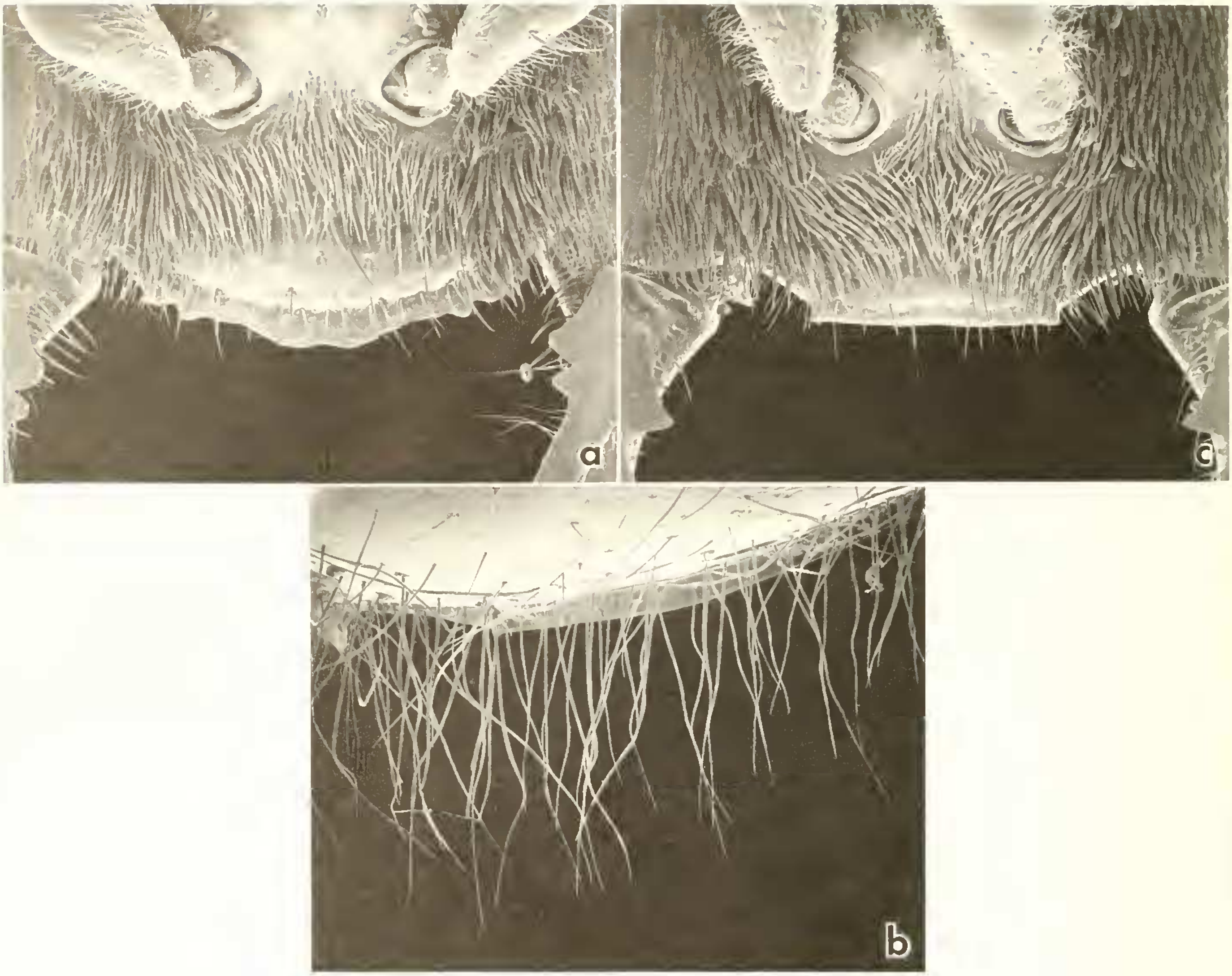

FIGURE 133. *Tachysphex menkei* Pulawski: a—female clypeus; b—female setae adjacent to hypostomal carina; c—male clypeus.

in some specimens. Femora black, tibia I red on inner face, tibia II and III black or largely red; tarsi red. Frontal vestiture golden, but silvery in smallest specimens.

LIFE HISTORY.—A paratype female is pinned with her prey: a young nymph of a decticine katydid, probably *Eremopedes* sp., det. A. B. Gurney.

GEOGRAPHIC DISTRIBUTION (Fig. 134).—Desert areas from southwestern Texas to southern California.

MATERIAL EXAMINED.—13♂, 44♀ (ANSP, ASU, CAS, CNC, CSDA, LACM, MCZ, NSDA, UAT, UCD, UMMZ, USNM, USU).

RECORDS.—UNITED STATES: ARIZONA: **Graham:** Roper Lake State Park, 18 mi E Safford. **Maricopa:** 30 mi E Gila Bend. **Pima:** Silver Bell. **Pinal:** Boyce Thompson Arboretum 3 mi W Superior. **Santa Cruz:** Canelo. **Yavapai:** 10 mi NW Congress, Prescott, 5 mi N Wickenburg. **Yuma:** 5 mi SW Bouse. CALIFORNIA: **Imperial:** 30 mi NE Glamis. **San Bernardino:** Adelanto. **San Diego:** Borrego Valley. **Riverside:** Andreas Canyon, Palm Springs. NEVADA: **Clark:** Cabin Creek S Mesquite. **Lincoln:** Garden Wash (ca. 12 mi E Carp). NEW MEXICO: **Otero:** Alamogordo. **Socorro:** Bernardo. TEXAS: **Brewster:** Alpine, Big Bend National Park (Dugout Well, Nine Point Draw, Santa Elena Canyon). **El Paso:** Tornillo. **Hudspeth:** McNary. **Presidio:** 3 mi E Presidio. UTAH: **Washington:** Paradise Canyon.

Tachysphex maya sp. n.

(Figures 130, 135)

DERIVATION OF NAME.—Named after the Maya Indians of Central America; noun in apposition.

DIAGNOSIS.—*Tachysphex maya* is unique among the New World species of the *brullii* group in having the propodeal dorsum setae oriented anterad on a broad, median zone that extends from the base to apex (the lateral setae are oriented posterad). Within the North American species of the *brullii* subgroup, *maya* is unique in having conspicuous mesopleural punctures. It resembles members of the *pompiliformis* group that have a similar orientation of the propodeal setae, but the female has the specialized apical tarsomere characteristic of the *brullii* group; the male has a distinctive combination of narrow vertex (width about 0.7 of length) and punctate mesopleuron.

DESCRIPTION.—Vertex with median sulcus that extends posterad from postocellar impression. Scutal hindcorner not prominent. Punctures: nearly contiguous on scutum; on mesopleuron well defined, large to fine, less than one diameter apart anteriorly and up to two or three diameters apart posteriorly. Propodeal dorsum microareolate; side impunctate anteriorly, punctate posteriorly. Terga densely micropunctate.

Setae: on vertex inclined (erect on postocellar impression), about 0.7 MOD long; on hypoepimeral area erect or nearly so, inclined on remaining mesopleuron; on propodeal dorsum oriented obliquely anterad on broad, median area that extends from base to apex, and oriented posterad on lateral, narrow area; appressed or nearly so on femora; underlying vestiture easily visible. Scutal setae oriented posterad.

Head, thorax, and legs black, tibial apex and tarsus red, also inner face of foretibia in some males (one from Cuernavaca, one from Junquillal Beach). Gaster red. Terga I–III fasciate apically, male tergum IV with interrupted fascia. Wings weakly infumate.

♀.—Labrum emarginate mesally. Clypeus (Fig. 135a): bevel longer than basomedian area; lip arcuate, shallowly emarginate mesally, with two lateral incisions on each side. Dorsal length of flagellomere I 2.0–2.2 × apical width. Vertex punctures up to one to two or two to three diameters apart mesally. Pygidial plate smooth or alutaceous, sparsely punctate. Tarsomeres V without spines on venter, but outer margin at midlength with one (foretarsus) or two (mid- and hindtarsus) spines in specimen from Guadalajara area; these spines are evanescent or absent in female from Tehuantepec area. Length 9.5–11.5 mm.

Setae length 1.3 MOD along hypostomal carina and on propodeal dorsum.

Clypeal and frontal vestiture silvery, with golden tinge.

♂.—Clypeus (Fig. 135b): bevel convex, shorter than basomedian area; lip arcuate, with prominent corners; distance between corners equal to clypeal midline. Dorsal length of flagellomere I 1.4–1.6 × apical width. Vertex punctures varying from less than one diameter apart up to two or three diameters apart mesally. Sterna densely punctate and pubescent mesally, sternal hindmargins without setal fasciae; sterna III–VI with graduli. Length 9.0–9.5 mm. Penis valve: Figure 135c.

Setae length 1.3 MOD along hypostomal carina and about 1.5 MOD on propodeal dorsum.

Clypeal and frontal vestiture golden.

Geographic Distribution (Fig. 130).—Mexico south of the Tropic of Cancer to Costa Rica.

Collecting Period.—2 March to 23 May.

Material Examined.—Holotype: ♂, Mexico: Chiapas: Villa Flores, 2 March 1953, RCB and EIS (UCD).

Paratypes (2♀, 4♂): MEXICO: **Jalisco:** 40 mi NE Guadalajara, 23 May 1956, H. A. Scullen (1♀, UCD). **Morelos:** Cuernavaca, 5 Mar 1969, HEE and D. M Anderson (1♂, CU). **Oaxaca:** 62 mi W Tehuantepec, 5 Mar 1985, LAS and R. Miller (1♀, CAS). **Sinaloa:** 9 mi E Chupaderos, 19 Mar 1962, LAS (1♂, CAS).

COSTA RICA **Guanacaste:** Junquillal Beach, 8 Mar 1976, RMB (1♂, UCD), Rio Corbici near Cañas, 8 Mar 1976, RMB (1♂, UCD).

Tachysphex acanthophorus Pulawski

(Figures 136, 137)

Tachysphex acanthophorus Pulawski, 1982:39, ♀, ♂. ! Holotype: ♀, Arizona, Cochise Co.: Willcox (UCD).

Diagnosis.—*Tachysphex acanthophorus* has laterally oriented midscutal setae, a character also found in *armatus* and *cocopa*. The female has a distinctive tarsomere V: one or two subapical spines are present on each lateral margin (Fig. 136b), and in most specimens also one or several midventral spines (Fig. 136b); there are no basoventral spines (that are present in *armatus*). An identical tarsomere V is also found in *cocopa* and

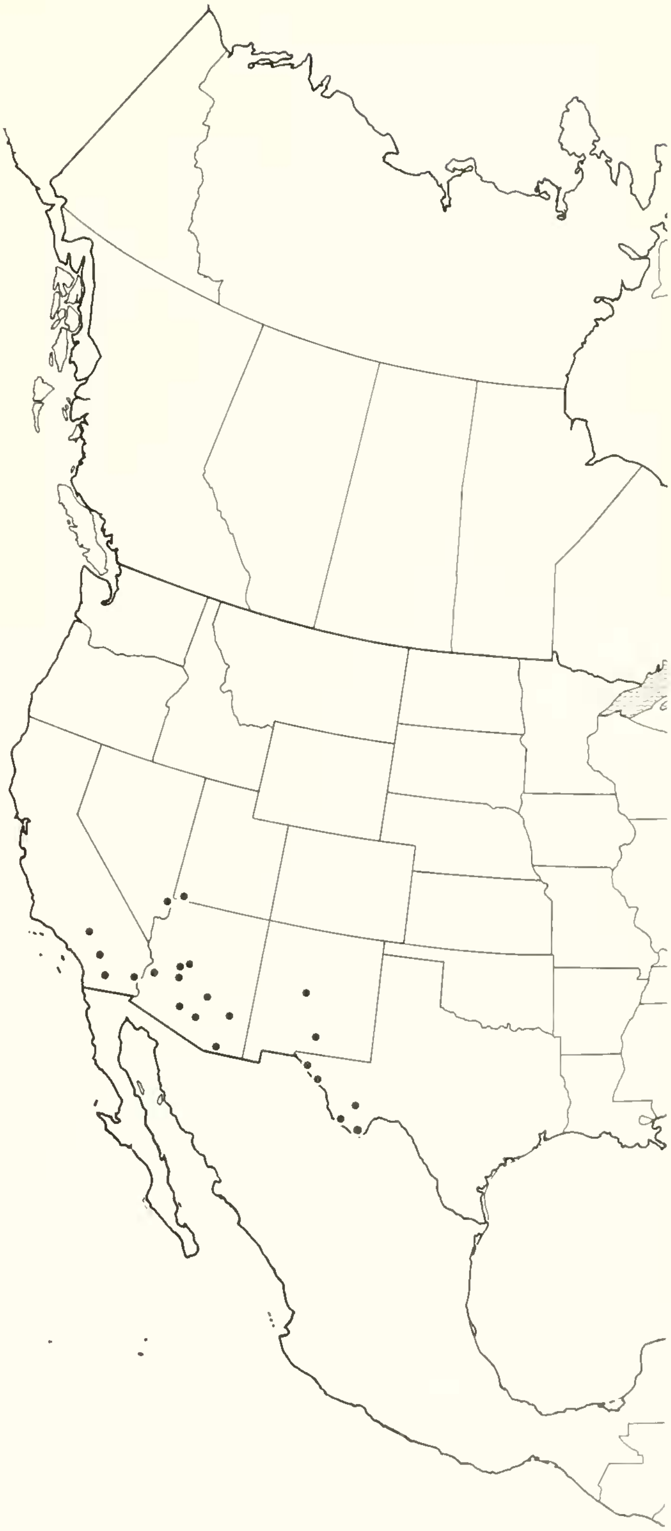

Figure 134 Geographic distribution of *Tachysphex menkei* Pulawski

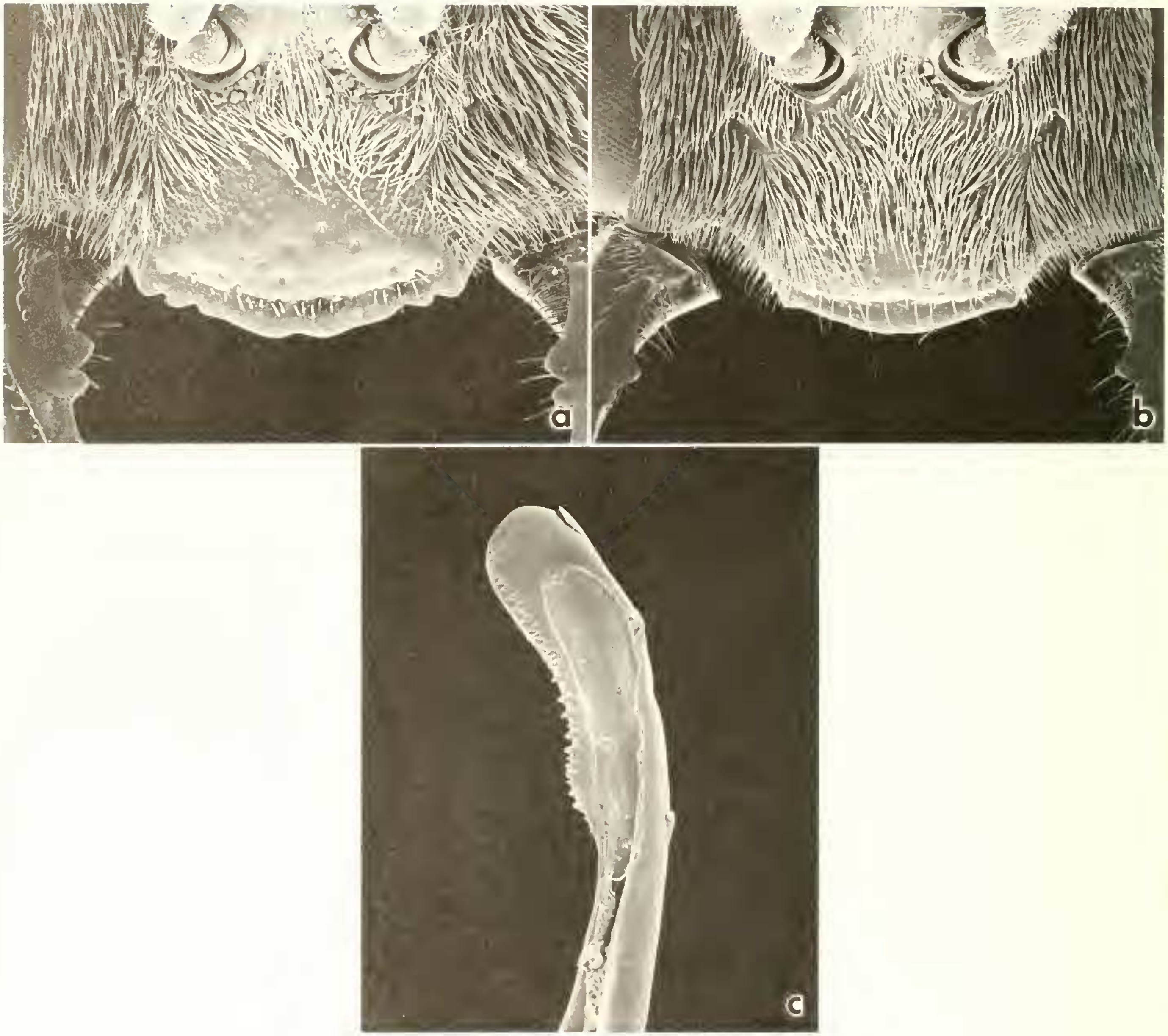

FIGURE 135. *Tachysphex maya* sp. n.: a—female clypeus, b—male clypeus, c—penis valve.

the South American *spinulosus* Pulawski, and the lateral spines are also found in most *aequalis*. However, the almost asetose pygidial plate separates *acanthophorus* from *cocopa* (in which the plate is densely setose throughout); the mesopleural vestiture is dense, partly obscuring integument (integument easily visible in *aequalis*); the gaster is red (at least basally); and the femora are black or the hindfemur is partly reddish (in *spinulosus*, the gaster is black, and the mid- and hindfemora are red).

Males of *acanthophorus* have a very narrow clypeal lip and lack a clypeal bevel (Fig. 136d); a transverse sulcus (visible only when sterna are fully extended) is present on sterna III–VI (Fig. 136e); and graduli are absent. These characters separate *acanthophorus* from all other species of the *brullii* group except *armatus* and *cocopa*. Males of these three species are very similar, and I was unable to separate them with certainty. The differences between males of *acanthophorus* and *cocopa* are unknown, but *acanthophorus* is widely distributed in southwestern United States and northern Mexico, and *cocopa* is known from only a few localities in southern Arizona, southern California, and northern Sonora, Mexico. The differences found between *acanthophorus* and *armatus* may actually be individual, and not specific. In *acanthophorus*, sternum II is somewhat swollen along the front margin of the apical depression, and the mesopleural integument is obscured by vestiture or nearly so; in *armatus*, the sternal surface is flat, and the mesopleural integument is easily visible.

DESCRIPTION.—Scutal and scutellar punctures minute, even, subcontiguous; scutal hindcorners roundly prominent. Propodeal dorsum microareolate, side minutely, indistinctly punctate (puncture evanescent in some specimens).

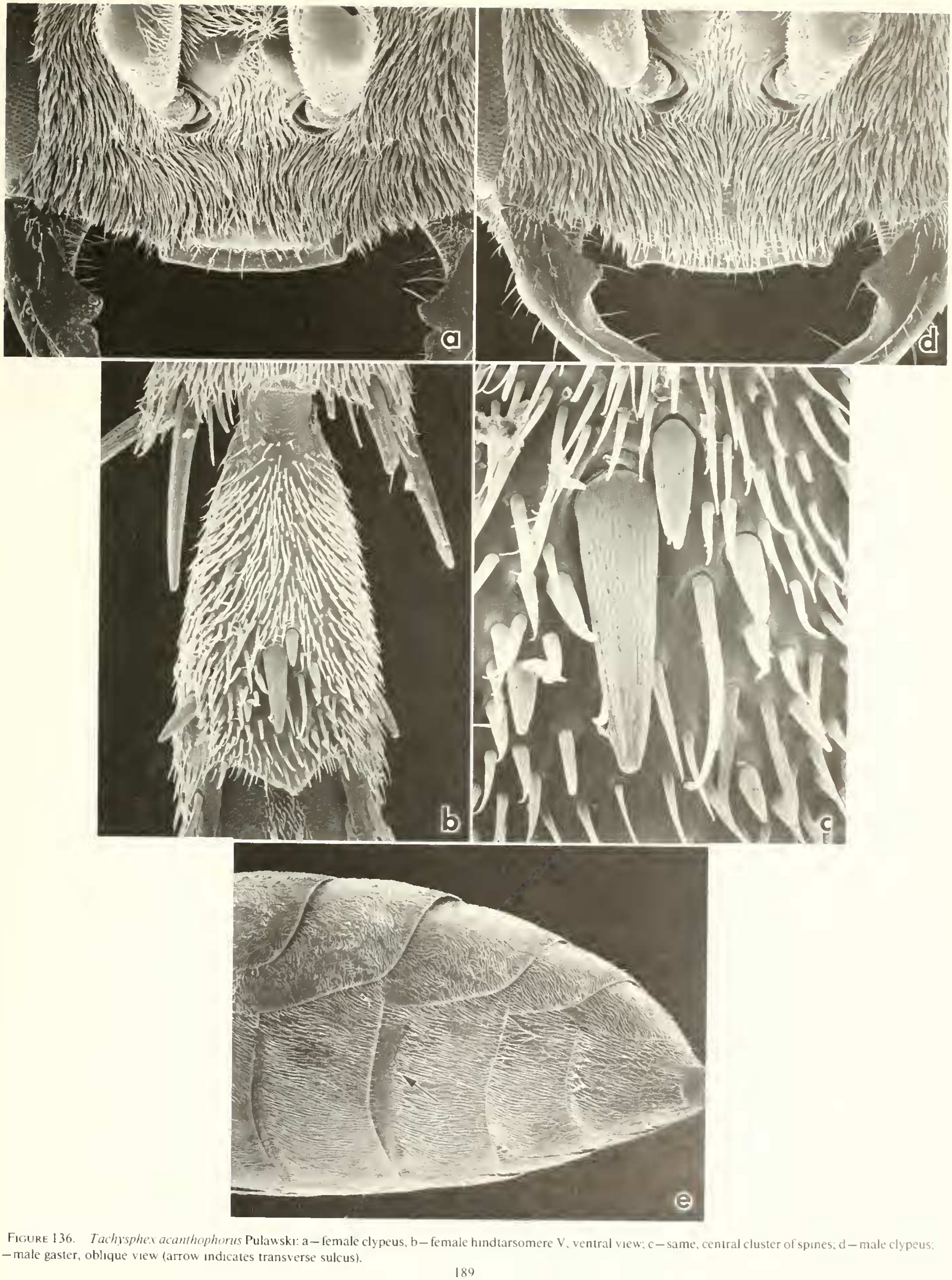

FIGURE 136. *Tachysphex acanthophorus* Pulawski: a—female clypeus, b—female hindtarsomere V, ventral view; c—same, central cluster of spines; d—male clypeus; e—male gaster, oblique view (arrow indicates transverse sulcus).

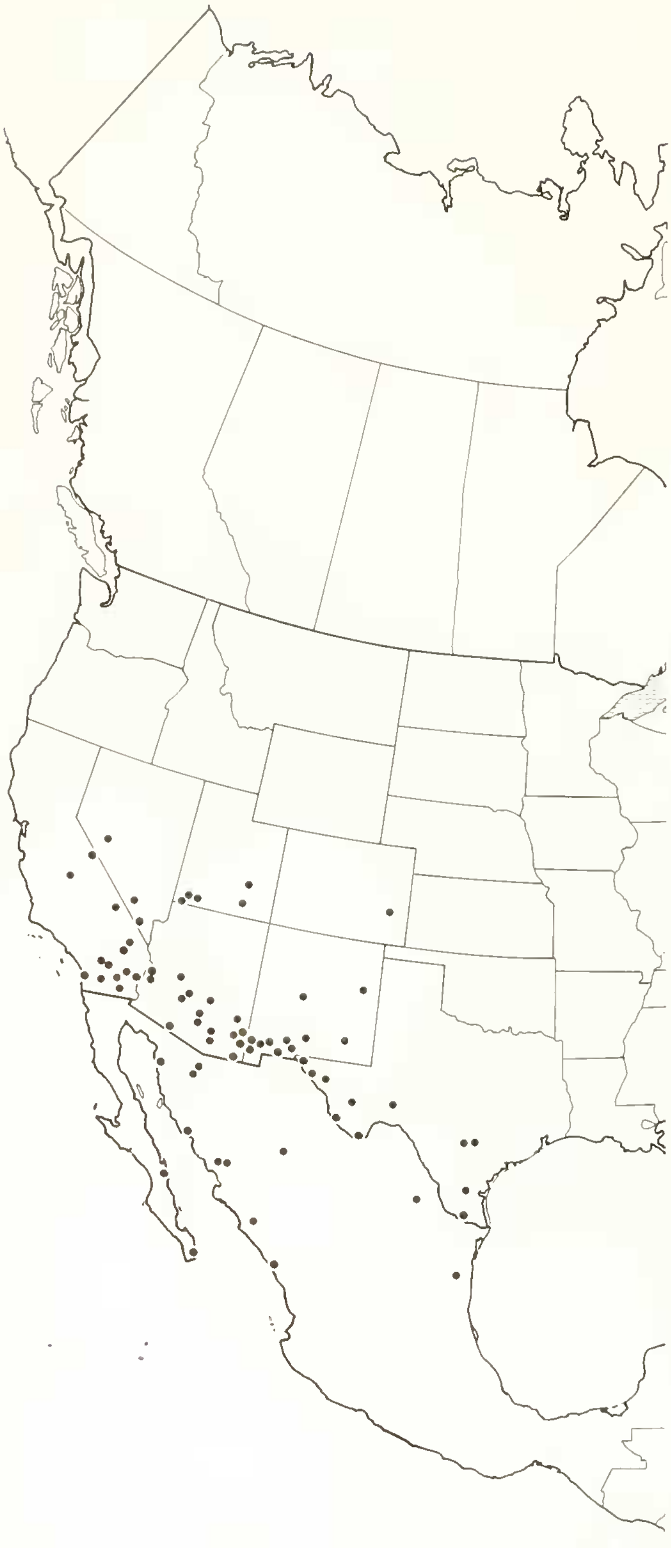

FIGURE 137. Geographic distribution of *Tachysphex acanthophorus* Pulawski.

Vestiture appressed on vertex, mesothorax, and femora; sculpture partly obscured on mesopleuron, largely or completely so on forefemoral venter. Midscutal setae oriented laterad (except setae on midline that are oriented posterad).

Gaster red or (some individuals) terga IV–VI dark (IV–VII in male); terga I–IV (I–V in some males) silvery fasciate apically. Wings hyaline.

♀.—Labrum at most weakly emarginate. Clypeal bevel almost as long as basomedian area to absent (some Texas and New Mexican individuals); lip entire or (some specimens) with one or two minute, lateral incisions on each side. Dorsal length of flagellomere I 1.6–2.0 × apical width. Vertex punctures minute, even, about one diameter apart or less, interspaces dull. Mesopleural punctures minute, dense, indistinct in some specimens. Tergal micropunctures dense. Pygidial plate moderately broad, with appressed setae. Forebasitarsus with five to nine rake spines. Tarsomere V with two subapical spines (one in some specimens) on each lateral margin, usually with central cluster of spines on venter (Fig. 136b, c). Length 5.5–7.0 mm.

Setae length about 1.2–1.4 MOD long along hypostomal carina and on propodeal dorsum.

Femora black or hindfemur partly reddish; tibiae black or largely red; tarsi red or (some specimens) black basally. Wings hyaline.

♂.—Clypeal bevel absent; lip narrower than in related species (except *armatus*), almost straight to weakly arcuate, corners obtuse to sharp, prominent. Dorsal length of flagellomere I 1.2–1.6 × apical width. Vertex punctures minute, indistinct, less than one diameter apart, interspaces microsculptured. Mesopleuron microsculptured, somewhat shiny, practically impunctate. Terga and sterna densely punctate and pubescent throughout; sterna III–VI (except laterally) with straight, transverse sulcus (which is visible only when segments are fully extended). Length 5.5–7.0 mm.

Setae length about 1.0 MOD along hypostomal carina and on propodeal dorsum.

Femora black. Tibia I red (at least on inner face), tibia II and III black or red; tarsi red. Frontal vestiture golden above, silvery below.

GEOGRAPHIC DISTRIBUTION (Fig. 137).—Xeric areas of southwestern United States and northern Mexico.

MATERIAL EXAMINED.—182♀, 203♂, 1 gynandromorph.

RECORDS.—UNITED STATES. ARIZONA: **Cochise:** Apache (also 1 mi E), Bowie, 7 mi SE Dos Cabezas, Douglas (also 2 mi E), Hereford, Portal (also 2 mi E, 2 mi S, 2 mi NE, 6.5 mi SE), Tombstone, Willcox. **Graham:** Roper Lake State Park (6 mi S Safford). **Maricopa:** 5 mi N Aguila, Phoenix, Rainbow Valley, Tempe, 5 mi SE Wickenburg. **Pima:** 30 mi SE Ajo, Continental, Sabino Canyon (Santa Catalina Mts.), Silver Bell, Tucson. **Pinal:** 5 mi NW Coolidge, Picacho Pass, Superior (Boyce Thompson Arboretum). **Yuma:** Palm Canyon, Parker, 7 mi S Quartzsite. CALIFORNIA: **Imperial:** Brawley, Hot Mineral. **Inyo:** Antelope Springs (8 mi SW Deep Springs), Deep Springs, Tecopa. **Riverside:** Blythe (also 12 mi N, 18 and 20 mi W), 12 mi W Desert Center, Indio, 3.5 mi S Palm Desert. **San Bernardino:** Amboy, 6 mi S Kelso. **San Diego:** Borrego, Torrey Pines State Park. **Tulare:** Lemon Cove, Three Rivers. COLORADO: **Bent:** Hasty. NEVADA: **Clark:** Sandy. **Mineral:** Luning. **Nye:** Mercury. NEW MEXICO: **Dona Ana:** Las Cruces, Leasburg Dam State Park. **Eddy:** 15.5 mi W Artesia. **Grant:** 25 mi E Lordsburg. **Hidalgo. Luna:** Columbus, 10 mi N Deming. **Otero:** White Sands National Monument. **Quay:** Tucumcari. **Socorro:** La Joya (20 mi N Socorro). TEXAS: **Bexar:** —. **Brewster:** Alpine, Big Bend National Park (Boquillas, Nine Point Draw, Rio Grande), Glenn Spring. **Crockett:** Fort Lancaster State Historical Park. **Duval:** 18 mi N San Diego. **El Paso:** 3 mi E Fabens. **Guadalupe:** Seguin. **Hidalgo:** McAllen Botanical Garden. **Hudspeth:** Fort Hancock, McNary, Sierra Blanca. **Presidio:** 3 mi E Presidio (also 11 mi N). UTAH: **Emery:** Bell Canyon in San Rafael Ridge, Wild Horse Creek W Goblin Valley. **Garfield:** Lake Powell (4 air mi NNW Bullfrog), Shootaring Canyon. **Washington:** Leeds Canyon, Paradise Canyon, St. George, Toquerville, Zion National Park.

MEXICO. **Baja California Sur:** 44 km S La Paz, 4 mi WSW Miraflores, Rancho Vinateria (22 km W Loreto, Sierra de la Giganta). **Chihuahua:** 15 mi S Chihuahua

Nuevo Leon: Vallecillo. **Sinaloa:** Culiacán, S Lorenzo, Mazatlán (also 2.5 and 5 mi N). **Sonora:** Alamos (also 10 mi SW), near Cucurpe, Desemboque, 20 mi S Estación Llano, Guaymas, 5 mi S Magdalena, Minas Nuevas, 10 mi E Navajoa, San Carlos (also 6 km NNW). **Tamaulipas:** Sierra Picachos.

Tachysphex armatus Pulawski

(Figures 138, 139)

Tachysphex armatus Pulawski, 1982:40, ♀, ♂. ! Holotype: ♀, Nevada: Clark Co.: Sandy (UCD).

DIAGNOSIS.—The female of *armatus* is unique among the North American *Tachysphex* in having basoventral spines on the tarsomere V (Fig. 138). Otherwise it is similar to *acanthophorus* and *cocopa* with which it shares transversely oriented midscutal setae and also other structures of the tarsomere V: one to several midventral spines and one or two preapical spines on each lateral margin. The pygidial plate of *armatus* is almost asetose (pygidial plate densely setose throughout in *cocopa*).

The male of *armatus* is very similar to *acanthophorus*. See that species for differences.

DESCRIPTION.—Scutal and scutellar punctures fine, even, subcontiguous; scutal hindcorner roundly prominent. Propodeal dorsum microareolate; side weakly microsculptured, shiny, at most with inconspicuous punctures that are two to three diameters apart.

Vestiture appressed on vertex, mesothorax, and femora, dense but not obscuring sculpture on mesopleuron and forefemoral venter. Midscutal setae oriented laterad (except setae on midline which are oriented posterad). Setae length about 0.8 MOD along hypostomal carina and 0.8–1.2 MOD on propodeal dorsum.

Gaster red; terga I–IV silvery fasciate apically. Wings hyaline.

♀.—Labrum not emarginate. Clypeal bevel equal to basomedian area or shorter; lip evenly arcuate, without mesal notch or lateral incisions. Dorsal length of flagellomere I 1.9–2.1 × apical width. Vertex dull, minutely, evenly punctate, punctures less than one diameter apart. Mesopleuron microsculptured, impunctate. Terga I–III densely micropunctate. Pygidial plate broad, with a few, sparse setae. Foretarsomere with seven to nine rake spines. Tarsomere V with basal spines ventrally and laterally, with one to three central spines on venter, with one or two preapical spines on each lateral margin (Fig. 138). Length 7.0–9.5 mm.

Legs black, tarsal apex red; inner face of foretibia reddish in some individuals.

♂.—Clypeal bevel absent; lip narrow, as in *acanthophorus*, almost straight, lateral corners acute (prominent) or obtuse. Dorsal length of flagellomere I 1.5–1.7 × apical width. Vertex microsculptured, punctures minute, less than one diameter apart. Mesopleuron microsculptured, somewhat shiny, practically impunctate. Terga and sterna densely punctate and pubescent throughout. Sterna III–VI (except laterally) with transverse sulcus (which is visible only when segments are fully extended). Length: 7.0–7.5 mm.

Femora black, tibiae dark with reddish zones, inner face of foretibia red, tarsi red. Frontal vestiture silvery, with golden tinge before midocellus.

GEOGRAPHIC DISTRIBUTION (Fig. 139).—Desert areas from southwestern Texas to California, also Baja California.

MATERIAL EXAMINED.—28♀, 23♂ (CAS, CIS, CNC, CSU, LACM, SDNH, UCD, UCR, USNM, USU).

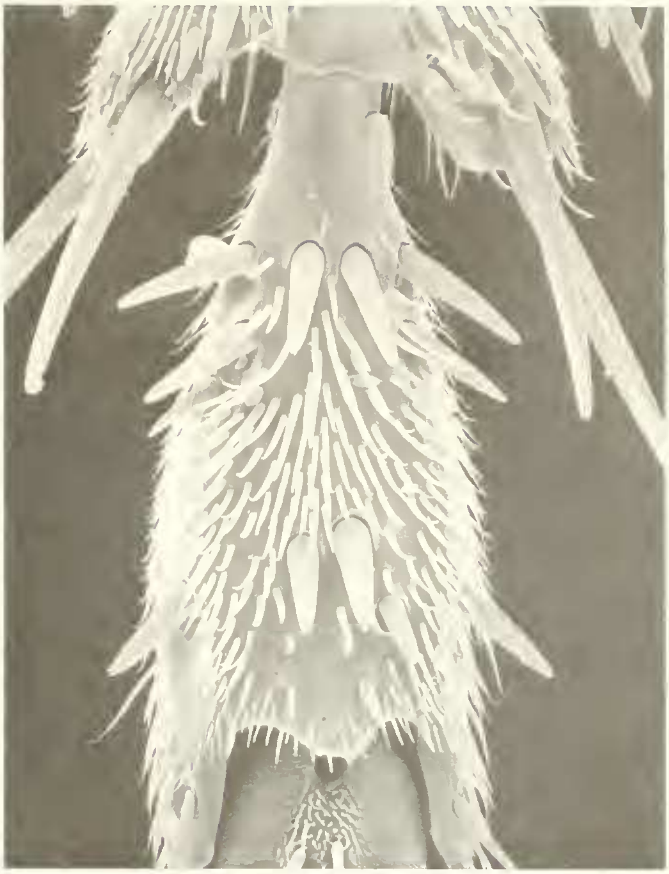

FIGURE 138. *Tachysphex armatus* Pulawski: a—female hindtarsomere V, ventral view

RECORDS.—UNITED STATES: ARIZONA: **Maricopa:** 10 mi E Gila Bend, Phoenix, 5 mi SE Wickenburg. **Pima:** Tucson. CALIFORNIA: **Inyo:** 12 mi N and 10 mi W Eureka Dunes. **Riverside:** Joshua Tree National Monument (36 road mi S Twentynine Palms). **San Diego:** San Diego. NEVADA: **Clark:** Sandy. **Lincoln:** Alamo. NEW MEXICO: **Dona Ana:** Leasburg Dam State Park. **Socorro:** Rio Salado 5 mi W Interstate Highway 25. TEXAS: **Brewster:** Big Bend National Park (Nine Point Draw). **Hudspeth:** Fort Hancock, McNary. **Presidio:** 11 mi N Presidio. UTAH: **Washington:** Leeds Canyon.

MEXICO: **Baja California Norte:** 38 km S Rosarito, 220 km S Tijuana. **Baja California Sur:** 7 mi SW La Paz, 13.5 mi S Loreto.

Tachysphex cocopa sp. n.

(Figures 139, 140)

DERIVATION OF NAME.—Named after the Cocopa Indians of the Yuman linguistic family, who lived near the mouth of Colorado River; a noun in apposition.

DIAGNOSIS.—*Tachysphex cocopa* is the only *Tachysphex* in which the pygidial plate of the female is totally covered with setae (Fig. 139). The presence of only five rake spines on the female forebasitarsus is an additional recognition feature. Otherwise the species is very similar to *acanthophorus*. Diagnostic characters are unknown for the male (see Discussion below).

DESCRIPTION.—Scutal and scutellar punctures fine, even, nearly contiguous. Scutal hindcorners rounded, not prominent. Propodeal dorsum microareolate; side micropunctate, shiny.

Vestiture appressed on vertex, mesothorax, and femora, largely obscuring sculpture on mesopleuron and forefemoral venter.

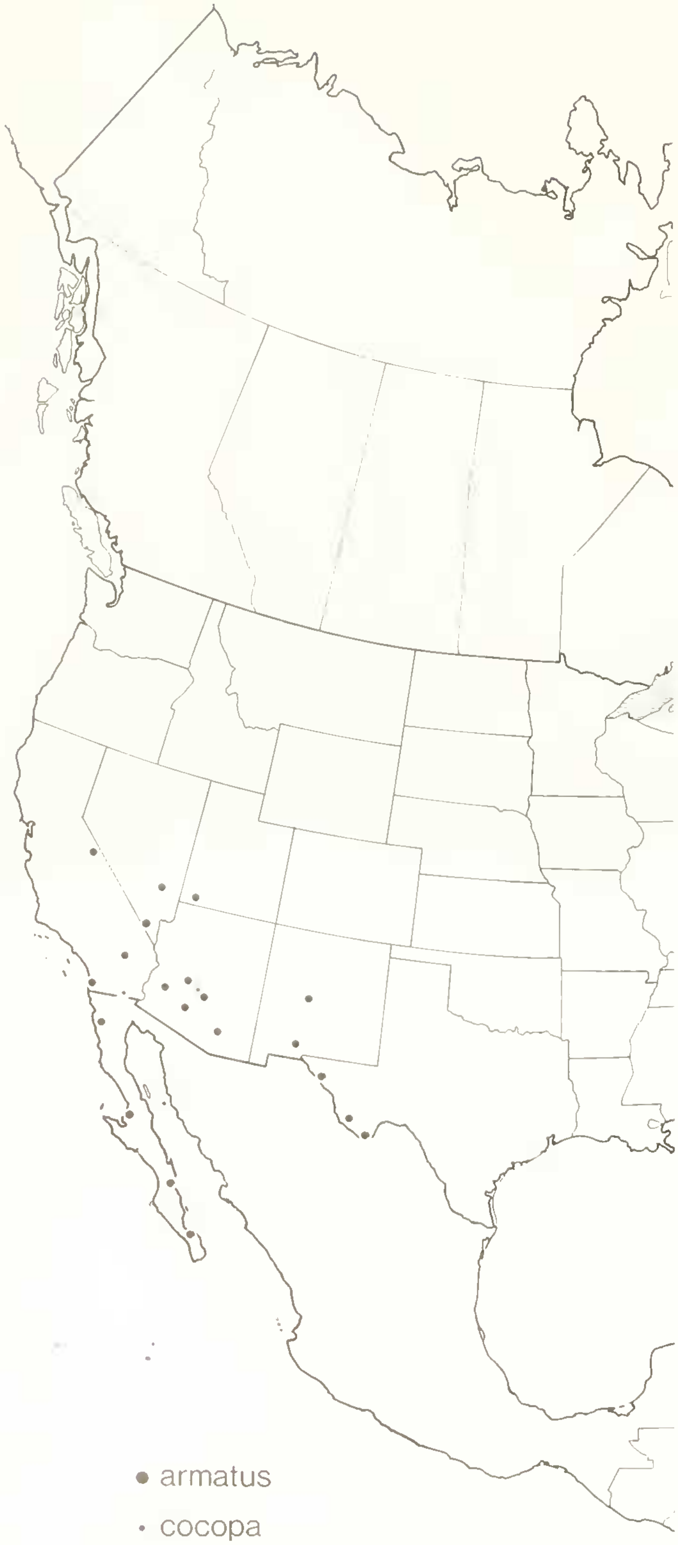

FIGURE 139. Geographic distribution of *Tachysphex armatus* Pulawski and *cocopa* sp. n.

Setae length about 0.8 MOD along hypostomal carina, about 1.0 MOD on propodeal dorsum.

Gaster red. Frontal vestiture silvery; terga I–IV silvery fasciate apically, tergum V with some silvery tomentum laterally. Wings hyaline.

♀.—Labrum not emarginate. Clypeal bevel shorter than basomedian area; lip evenly arcuate, without mesal notch or lateral incisions. Dorsal length of flagellomere I 1.7–2.0 × apical width. Vertex minutely, evenly punctate, punctures less than one diameter apart. Terga I–III densely micropunctate. Pygidial plate (Fig. 140) broad, densely punctate, and setose. Forebasitarsus with five rake spines. Tarsomere V with three or (some specimens) four preapical spines on each lateral margin, with a central group of spines on venter. Length 7.0–8.5 mm.

Fore- and midfemur black, hindfemur red or partly black; foretibia black except red at both ends and reddish on inner side; midtibia black, red on both ends, hindtibia red in continental specimens, largely black in specimens from Tiburón Island.

♂.—Clypeal bevel absent; lip arcuate, not prominent laterally. Dorsal length of tarsomere I 1.5 × width. Vertex micropunctate, punctures less than one diameter apart. Mesopleuron microsculptured, somewhat shiny. Terga and sterna densely punctate and pubescent throughout. Sterna III–VI (except laterally) with transverse sulcus which is visible only when sterna are fully extended. Length 7 mm.

Femora black; tibiae black, except red basally and apically, foretibia reddish on inner side.

DISCUSSION.—Two males, collected together with females of *cocopa* on Isla Tiburón, Mexico, are indistinguishable from *acanthophorus* and may in fact be that species. However, I assign them to *cocopa*, as no females of *acanthophorus* are known from the island.

GEOGRAPHIC DISTRIBUTION (Fig. 139).—Arizona, southern California, and Sonora, Mexico.

COLLECTING PERIOD.—10 May to 11 July.

MATERIAL EXAMINED.—Holotype ♀, Mexico, Sonora, SW part of Isla Tiburón, 10 May 1962, C. Bolinger (OSU, on permanent deposit to CAS, CAS Type #15916).

Paratypes (8♀, 2♂). UNITED STATES: ARIZONA: **Maricopa:** Phoenix, 18 May 1938, R. H. Crandall (1♀, UCD). CALIFORNIA: **Imperial:** Calexico, 11 July 1957, EIS (2♀, CAS, 1♀, UCD), 23 Sep 1957 (1♀, UCD).

MEXICO: **Sonora:** same data as holotype (2♀, 1♂ with gaster missing, CAS, 1♀, 1♀, OSU).

obscuripennis Subgroup

Female scutum and scutellum more or less flattened; outer side of foretibia without spines, with setae only; tarsomeres IV wider than long, obtusely emarginate apically; tarsomeres V angulate basoventrally in lateral view; claws asymmetrical (one claw in each pair being smaller), short, stout, arolium extending beyond their midlength; forebasitarsus with five to seven rake spines.

Prey consists of blattids. The subgroup is poorly represented in the Nearctic Region, and its species are limited to its southern part (Florida, southern Texas, and Sonora, Mexico). It is well represented in all other zoogeographic regions.

The three members of the subgroup share the following characters: vestiture not obscuring integument between antennal socket and orbit; scutum with well-defined punctures, its hindcorner roundly prominent. Female labrum emarginate; forefemoral venter sparsely punctate, interspaces unsculptured or finely microsculptured; tarsomeres V with row of short spines on each lateral margin, apicoventral margin produced into lobe. Male vertex wider than long; tergum VII densely punctate.

Tachysphex inconspicuus (Kirby)

(Figures 141–143)

Tachytes inconspicuus Kirby, 1890:540, ♀, ♂. ! Lectotype: ♀, Brazil: Fernando de Noronha Island (BMNH), designated by Pulawski 1974*a*:74.—In *Tachysphex*: Pulawski 1974*a*:74 (full bibliography), Bohart and Menke 1976:274

Tachysphex blatticidus Williams, 1941:197, ♀, ♂. ! Holotype: ♀, Trinidad and Tobago: Trinidad Island: St. Augustine (BMNH). Synonymized by Pulawski 1974*a*:74.

Diagnosis.—*Tachysphex inconspicuus* has a basal tooth (Fig. 141c) on the hindcoxa (tooth absent in *iridipennis*), and setae of the propodeal dorsum are erect or inclined posterad (basomedian setae oriented anterad in *alayoi*). The female hindfemur is slenderer (Fig. 141d) than in the other two, and the tarsomere IV is undulate apicoventrally, not produced into lobe (Fig. 142c, e). The male sterna are densely punctate and pubescent (sterna IV–VI almost impunctate and glabrous in *alayoi*, sparsely punctate in *iridipennis*), and the foretarsal rake is absent (preapical rake spines present on forebasitarsus in *iridipennis* and many *alayoi*). In most specimens the vertex setae are 1.0–1.5 MOD long (1.5–3.0 in the two other species), the propodeal side is not ridged, the clypeal lip of the female has two lateral incisions (Fig. 141a) (not incised in the other two), and the rake spines of the female foretarsus are 2.5–3.0× the basitarsal width (1.2–2.0× in the other two).

Description.—Frons dull, microsculptured. Vertex in most specimens with two swellings behind postocellar impression. Scutal and mesopleural punctures no less than one diameter apart. Axilla steplike. Punctures of mesothoracic venter about one diameter apart. Metapleuron in most specimens with longitudinal carina beneath flange, the latter broad. Propodeal dorsum rugose or longitudinally ridged (Fig. 141b), smooth apically in some specimens, carinate along hindmargin (also along lateral margin in some specimens); side punctate (punctures inconspicuous in some females), rarely ridged apicoventrally or (some males) largely rugose. Hindcoxa with prominent tooth basally (Fig. 141c).

Setae of propodeal dorsum erect or slightly inclined posterad (Fig. 141b).

Body black, tarsi red or reddish except black in Jamaican specimens. Terga I–IV or I–V silvery fasciate apically. Wings hyaline to infumate in female, slightly infumate in male.

♀.—Clypeus (Fig. 141a): bevel one-third to half length of basomedian area, indistinctly delimited from the latter; lip straight to slightly sinuate, with mesal notch, in most specimens with two lateral incisions. Dorsal length of flagellomere I 1.5–2.3× apical width. Vertex width 1.1–1.4× length. Punctures shallow on frons (inconspicuous in some specimens); dense to sparse on vertex; well defined to faint on mesopleuron (interspaces shiny); dense on tergum V (apical depression impunctate). Scutellum and postscutellum flattened but somewhat convex, scutum in many specimens longitudinally crenulate along hindmargin. Pygidial plate punctate, asetose, broad to (some specimens) narrow. Rake spines of forebasitarsus 2.5–3.0× width of basitarsus. Hindfemur slender (Fig. 141d). Tarsomere IV (Fig. 142a–d): apical emargination weakly obtuse, its membrane exposed (hidden in other *Tachysphex*), apicoventral margin undulate, not expanded into a lobe. Tarsomere V: Figure 142e. Length 7.0–8.5 mm.

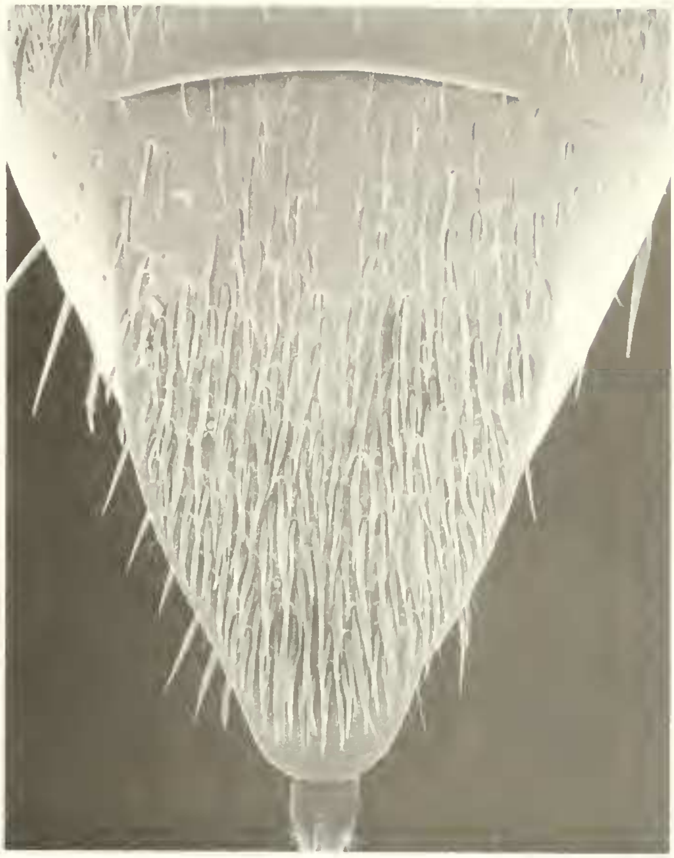

Figure 140. *Tachysphex cocopa* sp. n.: pygidial plate of female.

Setae erect, in most specimens 1.0–1.5 MOD long on vertex, about 1.0 MOD on scutum and midfemoral venter. Foretibia densely pubescent throughout.

♂.—Clypeus (Fig. 141e): bevel absent; lip varying: straight, broadly arcuate, or with obtuse, median projection; corners angulate but not prominent, slightly closer to orbit than to each other (rarely closer to each other). Dorsal length of flagellomere I 1.2–1.8× apical width. Frons punctate (only shallowly so in some individuals). Vertex width 1.3–1.7× length. Sterna densely punctate and pubescent throughout. Forefemoral notch glabrous. Foretarsus without rake. Length 5.5–8.0 mm.

Setae erect on vertex, suberect on scutum; 1.0–1.2 MOD long on vertex and scutum, about 0.6 MOD on midfemoral venter, at most 0.5 MOD on hindfemoral venter.

Variation.—In a female from Turrialba, Costa Rica (CAS), the clypeal lip is not incised laterally, and the vertex setae are 2.5 MOD long. Occasional specimens from Peru and Ecuador are similar. The rake spines may be unusually short in some South American females (see Pulawski 1974*a*).

Life History.—Available data were summarized by Pulawski (1974*a*). Females nest in sand and provision with adult roaches

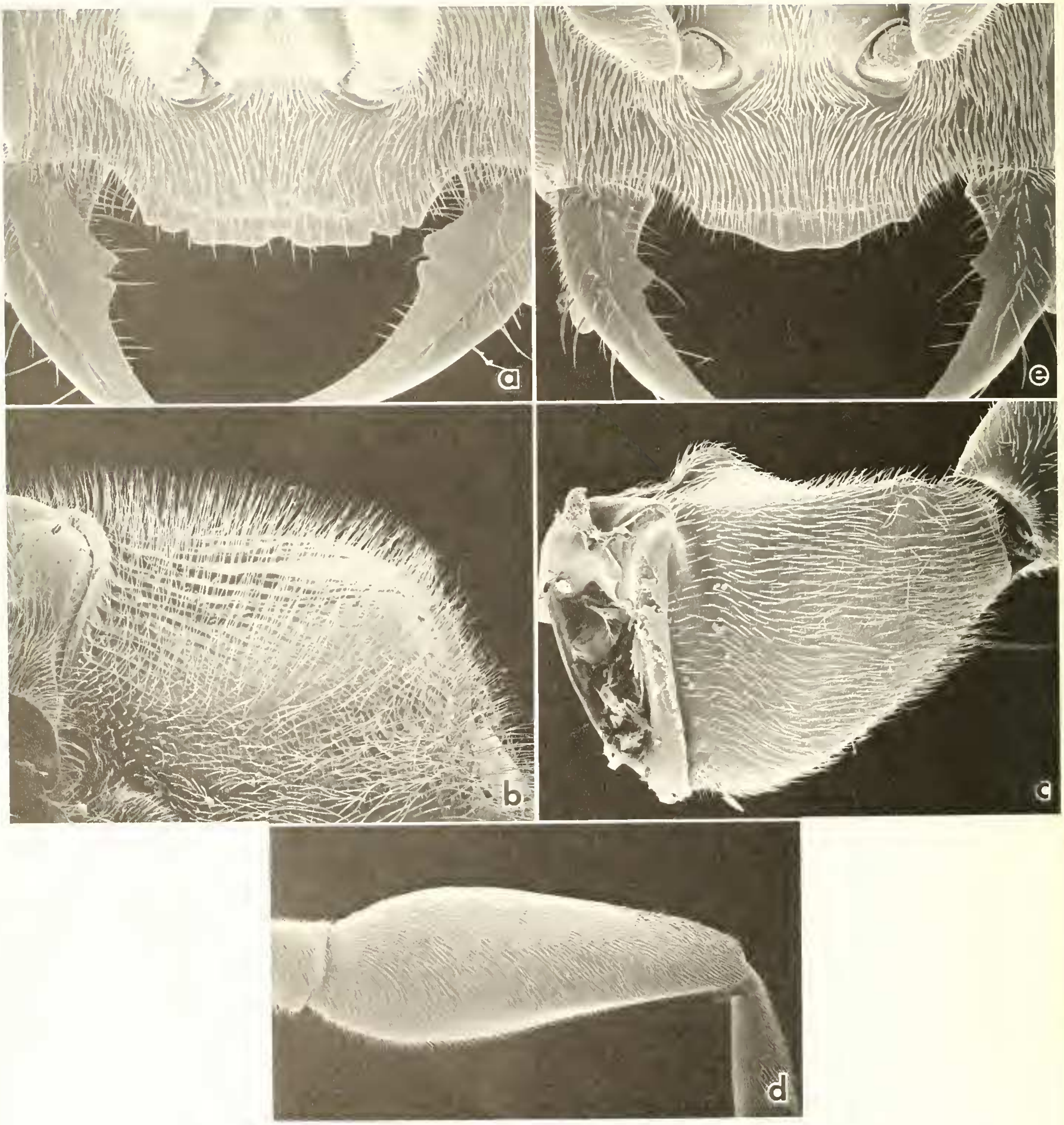

FIGURE 141. *Tachysphex inconspicuus* (Kirby). a—female clypeus, b—female propodeum; c—female hindcoxa, d—female hindfemur; e—male clypeus.

of the genus *Choristoneura* and *Riatia*. The mutillid *Timulla eriphyla* Mickel is a parasite.

GEOGRAPHIC DISTRIBUTION (Fig. 143).—Central and South America between Tropic of Cancer and Tropic of Capricorn, and also Jamaica (where it occurs sympatrically with *alayoi*, although not in the same habitats).

MATERIAL EXAMINED.—44♀, 55♂ from Mexico and Central America (AMNH, CAS, CIS, CNC, KU, LACM, MCZ, UCD, USU), 5♀, 2♂ from Trinidad and Tobago (FSCA), 3♀, 2♂ from Jamaica (CAS, FSCA).

RECORDS.—MEXICO: **Chiapas:** Ixtapa, 2 mi SE Ococingo, Ocozocoautla, 32 mi W San Cristóbal, Simojovel. **Jalisco:** Barra de Navidad, Chamela, Puerto Vallarta. **Morelos:** 5 mi E Cuernavaca, 6 mi S Temixco. **San Luis Potosi:** El Bonito (7 mi S Ciudad Valles). **Sinaloa:** 3 mi N Elota. **Tamaulipas:** La Pesca, Playa

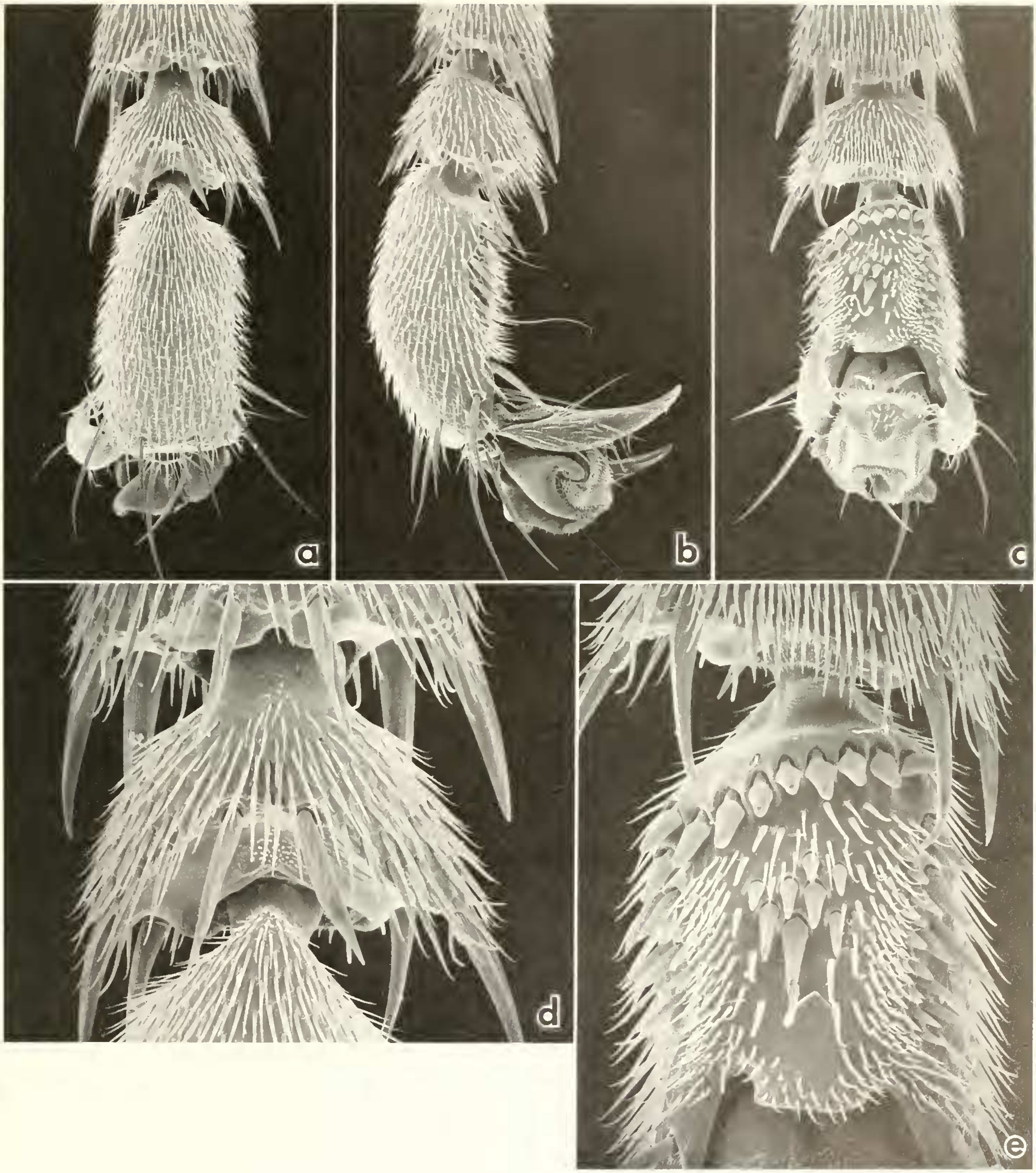

Figure 142. *Tachysphex inconspicuus* (Kirby), female: a—apical hindtarsomeres, dorsal view; b—same, lateral view; c—same, ventral view; d—hindtarsomere IV, dorsal view; e—hindtarsomere V, ventral view.

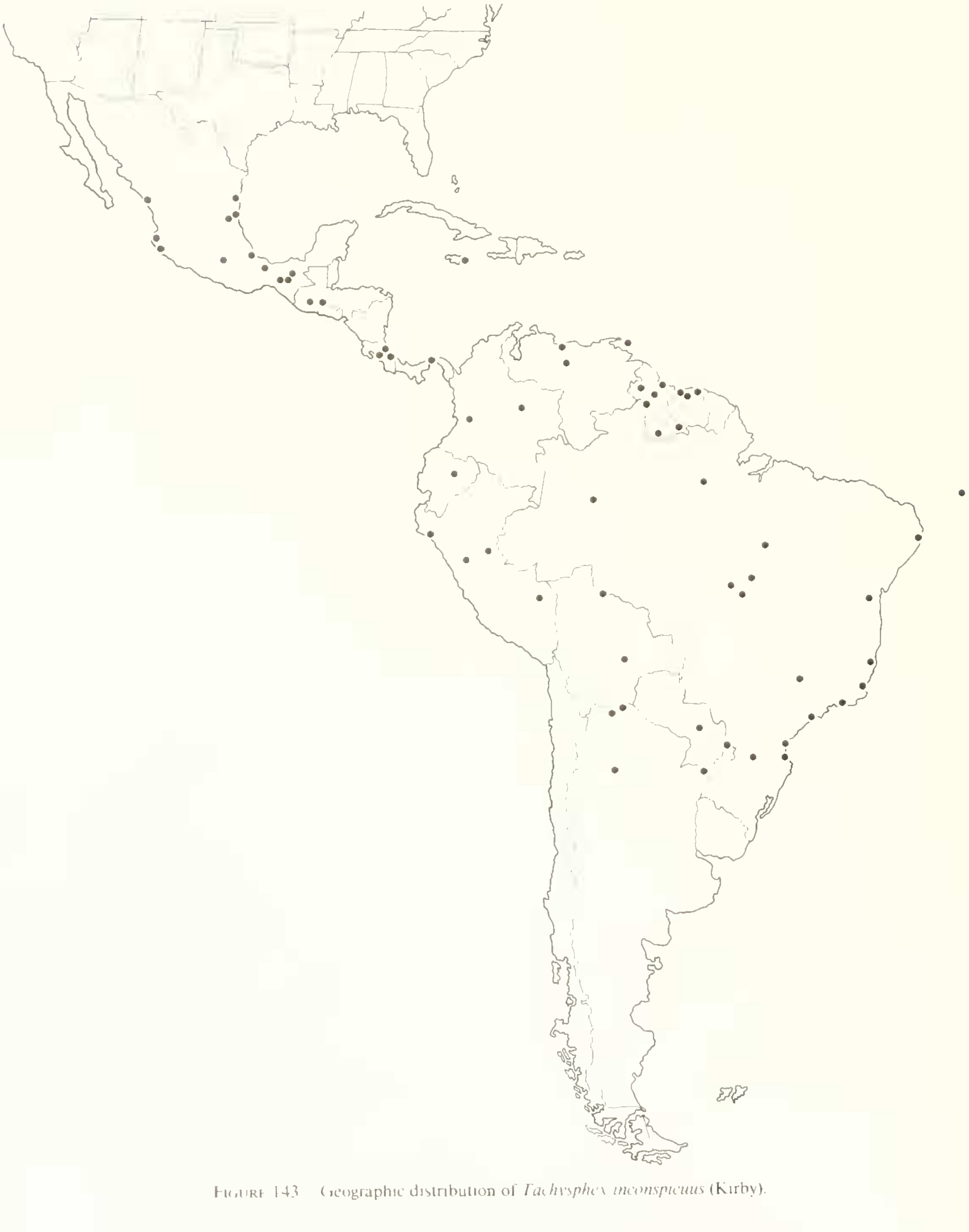

FIGURE 143 Geographic distribution of *Tachysphex inconspicuus* (Kirby).

Altamira, Municipio de Aldama (Rancho Nuevo). **Veracruz:** 30 mi S Acayucan, Atovac (Pulawski 1974*a*)

CENTRAL AMERICA COSTA RICA Boca de Barranca, La Selva (4 km SE Puerto Viejo), Limon, Tilarán (Pulawski 1974*a*), Tortuguero, Turrialba. GUATEMALA Antigua, Guatalon. PANAMA Canal Zone and neighboring area (Pulawski 1974*a*), 20 km N Curundu

WEST INDIES JAMAICA **Portland Parish:** Paradise. **St. Andrew Parish:** Mammee River Valley near Kingston. TRINIDAD AND TOBAGO **Trinidad:** Simla Field Station **Tobago:** 1 mi ESE Adelphi

SOUTH AMERICA (localities listed in Pulawski 1974*a*, are not repeated here). ARGENTINA **Corrientes:** Puerto Valle–Ituzaingo. COLOMBIA **Meta:** Carimagua (17 km E El Porvenir), El Porvenir **Valle:** Atuncela. ECUADOR **Napo:** Limoncocha on Rio Napo. PARAGUAY San Pedro Cororo–Rio Ipane. PERU **Huanuco:** Tingo Maria in Monson Valley VENEZUELA **Aragua:** 16 km NW of Maracay **Guarico:** 44 km S Calabozo

Tachysphex iridipennis (F. Smith)

(Figures 144–145)

Tachytes iridipennis F. Smith, 1873:57, ♀. Holotype: ♀, Brazil: Ega [=Tefé] (BMNH).—In *Tachysphex*: Pulawski 1974*a*:80 (full bibliography), Bohart and Menke 1976:274

DIAGNOSIS.—Unlike the other two New World blattid collectors, *iridipennis* lacks the hindcoxal tooth. It differs from *inconspicuus* by the following: in the female, the vertex is broader (width : length = 1.8–2.1 instead of 1.1–1.4), the clypeal lip is not incised laterally (Fig. 144a) (incised in most *inconspicuus*), the hindfemur is stout (Fig. 144b), the apicoventral margin of tarsomere IV is expanded into a lobe, and the pygidial plate of

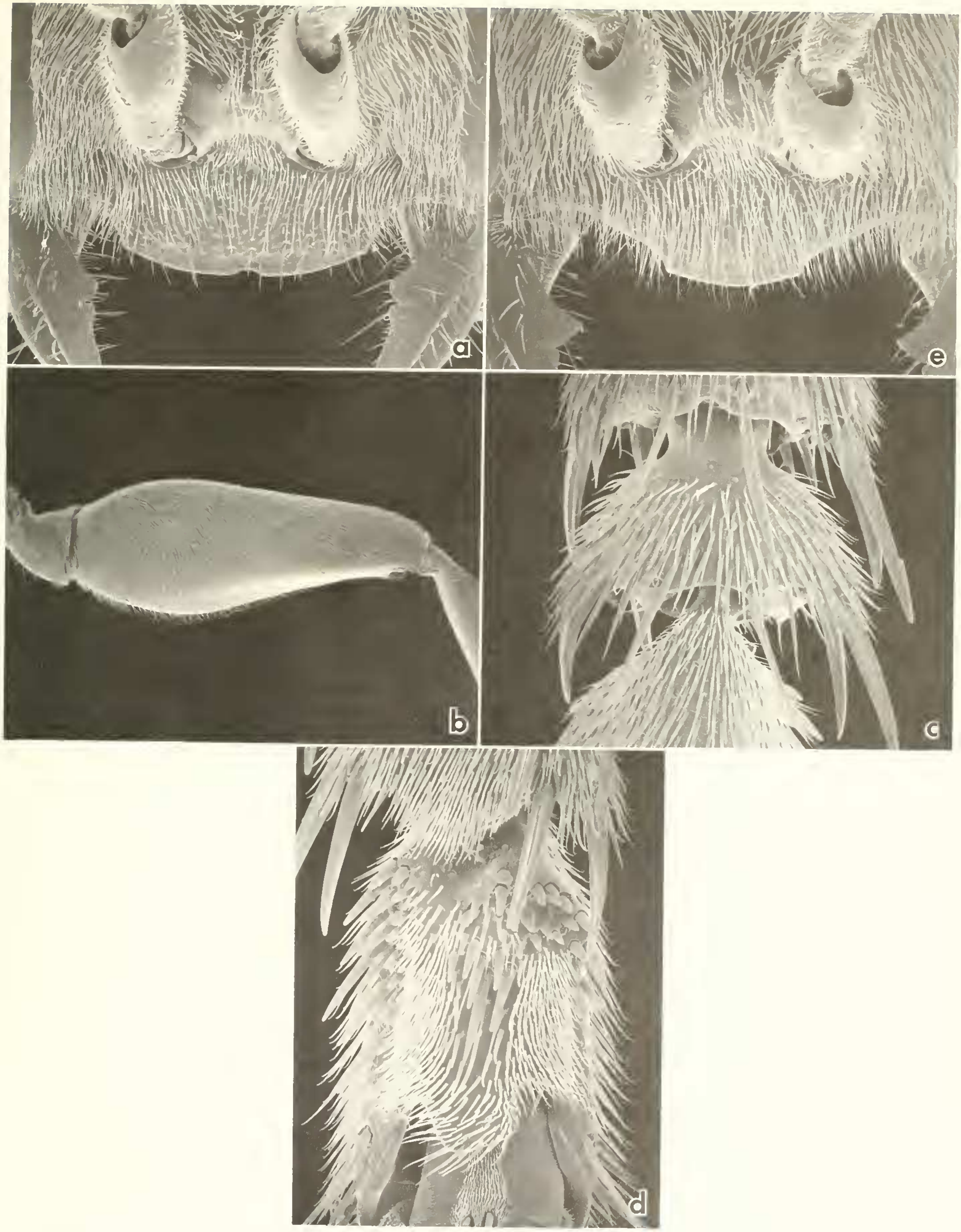

FIGURE 144 *Tachysphex iridipennis* (F. Smith): a—female clypeus; b—female hindfemur; c—female hindtarsomere IV, dorsal view; d—female hindtarsomere V, ventral view; e—male clypeus.

many specimens is setose; in the male, sterna III–VI are sparsely punctate and pubescent, and the forebasitarsus has preapical rake spines. The clypeal lobe of the male is narrower (Fig. 144e) than in *alayoi* and most *inconspicuus* (corners closer to each other than to orbit). Unlike *alayoi*, setae of propodeal dorsum are uniformly inclined posterad in *iridipennis* (basomedian setae oriented anterad in *alayoi*), the gaster is all black (gastral tip red in most *alayoi*), and tergum V of most females is densely punctate before the apical depression.

Description.—Scutum longitudinally crenulate along hindmargin. Axilla not steplike. Metapleuron without longitudinal carina beneath flange, the latter moderately broad. Propodeal dorsum longitudinally ridged, carinate along hind and lateral margins; side ridged, but ridges evanescent in occasional specimens. Hindcoxa without basal tooth.

Setae of propodeal dorsum inclined posterad.

Body black, tarsi brown reddish in male (basitarsus in some specimens dark) and occasional females. Terga I–IV (I–III in some males) silvery fasciate apically. Wings hyaline to infumate (slightly so in male).

♀.—Clypeus (Fig. 144a): middle area shiny apically, dull, densely punctate basally (basomedian area, bevel and lip not differentiated); free margin of lobe arcuate or biarcuate, shallowly notched mesally, not incised laterally. Dorsal length of flagellomere I 1.9–2.4 × apical width. Vertex width 1.8–2.1 × length. Punctures more than one diameter apart on frons (rarely one diameter apart), vertex, scutum, mesopleuron, and mesosternum; fine to coarse on frons (interspaces microsculptured); in most specimens about one diameter apart on tergum V (apical depression impunctate). Mesothoracic interspaces slightly microsculptured, shiny. Pygidial plate in most specimens with elongate punctures and appressed setae that are sparse anteriorly and dense apically, in some specimens with appressed inconspicuous setae. Rake spines of forebasitarsus 1.2–1.7 × basitarsal width (2.0 × in some Guyanese individuals). Hindfemur stouter than in *inconspicuus* and *alayoi*. Tarsomere IV (Fig. 144c): apical emargination very obtuse, apicoventral margin produced into a lobe. Tarsomere V: Figure 144d. Length 8.0–10.5 mm.

Setae erect, two to three MOD long on vertex; erect or suberect, 1.0–1.7 MOD long on scutum; about 1.5 MOD long on midfemoral venter. Outer face of foretibia sparsely pruinose.

♂.—Clypeus (Fig. 144e): lobe densely punctate, with short, minute carina extending from each lip corner; lip slightly arcuate, indistinctly delimited basally; its corners rounded to sharply prominent, closer to each other than to orbit. Dorsal length of flagellomere I 1.5–2.0 × apical width. Frons below midocellus dull or shiny. Vertex width 1.75–2.4 × length. Punctures no less than one diameter apart on frons; one to several diameters apart on vertex; coarse on scutum (more than one diameter apart on disk); on mesopleuron coarse except posteriorly, more than one diameter apart (at least posteriorly); in most individuals more than one diameter apart on mesothoracic venter. Tergum VII with sharp, longitudinal carina on side; sterna III–VI pubescent, sparsely punctate. Forefemoral notch deeper than in *inconspicuus* and *alayoi*, with glabrous, sharply delimited bottom. Forebasitarsus with three or four preapical rake spines whose length is less than basitarsus width; apical spine of foretarsomere II much shorter than tarsomere III. Length 5–10 mm.

Setae erect, 2.0–2.5 MOD long on vertex; suberect, 2.0 MOD long on scutum; about 1.5 MOD long on midfemoral venter; suberect, 1.0 MOD long on hindfemoral venter.

Life History.—This species is known to prey upon adults of the roach *Cariblatta tobagensis* Hebard (see Pulawski 1974*a*). In addition, a specimen from El Coco, Costa Rica (CSDA) is pinned with a nearly adult blatellid *Ischnoptera rufa debilis* Hebard (det. D. A. Nickle), and I collected a female carrying an adult blatellid *Euthlastoblatta abortiva* Caudell (det. D. A. Nickle) in Bentsen Rio Grande Valley State Park, Texas.

Geographic Distribution (Fig. 145).—Southern Texas to Tropic of Capricorn.

Material Examined.—9♀, 10♂ from United States, Mexico, and Central America (CAS, CIS, CSDA, FSCA, KU, MCZ, UCD, UCR).

Records (South American localities listed in Pulawski (1974*a*) are not repeated here).—UNITED STATES: TEXAS: **Hidalgo:** Bentsen Rio Grande Valley State Park (2♀, 1♂, CAS).

MEXICO: **Colima:** Manzanillo (Pulawski 1974*a*). **Sinaloa:** 2.5 mi N Mazatlán, Rio Fuerte 11.6 mi N Los Mochis. **Sonora:** Cócorit. **Tamaulipas:** La Pesca, Municipio de Aldama (Pueblo Nuevo), Playa Altamira. **Veracruz:** Minatitlán.

CENTRAL AMERICA. COSTA RICA: **Guanacaste Prov.:** El Coco. PANAMA: Archipelago de las Perlas, Canal Zone and adjacent area (Pulawski 1974*a*).

SOUTH AMERICA. COLOMBIA. **Meta:** El Porvenir. VENEZUELA: **Aragua:** 2 km N Ocumare. **Falcon:** Peninsula Paraguana (Pueblo Nuevo). **Merida:** 38 km SW Mérida. **Zulia:** Carrasquero, 31 km SW Machiques, Rio Palmar 15 km NE Rosario.

Tachysphex alayoi Pulawski

(Figures 145, 146)

Tachysphex alayoi Pulawski, 1974*a*:84, ♀, ♂. ! Holotype: ♀, Cuba: Oriente Province: Juraguya near Guantanamo (USNM).—Bohart and Menke 1976:272, Krombein 1979:1632, Elliott et al. 1979:356.

Diagnosis.—*Tachysphex alayoi* is the only blattid-hunting *Tachysphex* known from Florida and most of the West Indies (but it coexists with *inconspicuus* in Jamaica). Unlike *inconspicuus* and *iridipennis*, basomedian setae of the propodeal dorsum are inclined anterad, and the gastral tip is red in most specimens. Unlike *inconspicuus*, the propodeal side is ridged, the female clypeal lip (Fig. 146a) is not incised laterally (incised in vast majority of *inconspicuus*), the tarsomere IV is very obtusely emarginate, with apicoventral margin produced into a lobe (Fig. 146b, c), and male sterna IV–VI are nearly impunctate and glabrous. Unlike *iridipennis*, the hindcoxa of *alayoi* has a basal tooth, female tergum V is sparsely punctate, and the male clypeal lobe is broad (Fig. 146d), with corners closer to orbit than to each other.

Description.—Scutum not crenulate before hindmargin (but with contiguous punctures). Axilla not steplike. Metapleuron without longitudinal carina beneath flange, the latter narrow. Propodeal dorsum longitudinally ridged (ridges in some individuals inconspicuous or replaced by irregular reticulation), weakly carinate along hindmargin and not carinate along lateral margin; side ridged. Hindcoxa with basal tooth (that is inconspicuous in small males).

Setae erect on vertex and scutum, on propodeal dorsum inclined anterad basomedially and posterad laterally and posteriorly.

Terga I–IV (I–III in many females) silvery fasciate apically. Wings hyaline.

♀.—Clypeus (Fig. 146a): middle section with large punctures, microsculptured along frontoclypeal suture; lip absent or indistinct; free margin of lobe sinuate, emarginate mesally, not in-

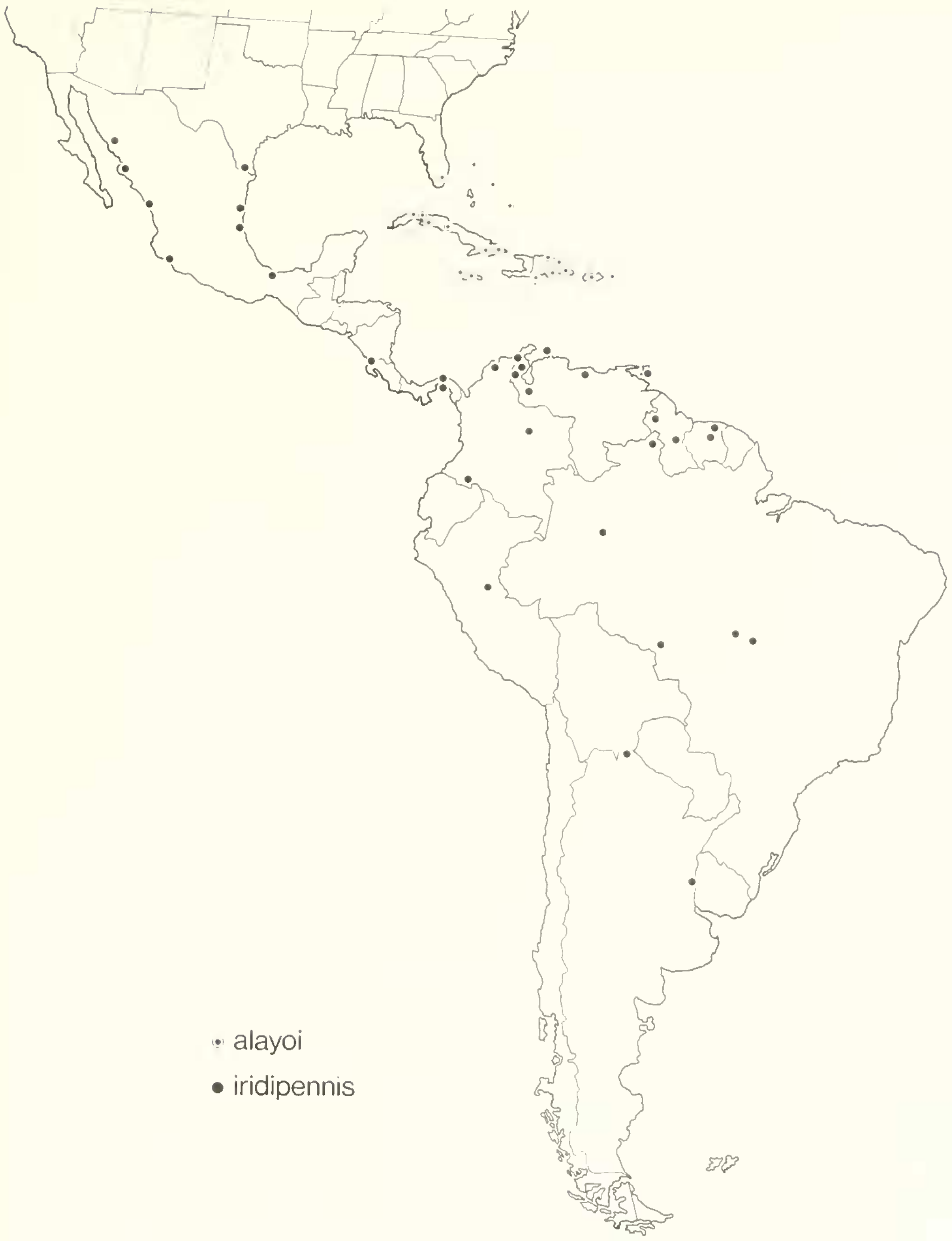

FIGURE 145. Geographic distribution of *Tachysphex alayoi* Pulawski and *iridipennis* (F. Smith)

cised laterally. Dorsal length of flagellomere I 1.8–2.3× apical width. Vertex width 1.3–1.6× length. Punctures about one diameter apart before midocellus (interspaces microsculptured); large, at least one diameter apart behind postocellar impression; more than one diameter apart on mesopleuron and mesothoracic venter, fine on mesopleuron (interspaces alutaceous); many diameters apart on tergum V. Some punctures of scutal disk subcontiguous, others slightly more than one diameter apart. Pygidial plate fairly broad (also apically), asetose. Rake spines of forebasitarsus 1.4–1.6× width of basitarsus. Hindfemur stout, as in *iridipennis*. Tarsomere IV (Fig. 146b, c): apical emargination IV very obtuse; apicoventral margin produced into a lobe. Tarsomere V: Figure 146c. Length 6–12 mm.

Setae length (in MOD): 2.0 or nearly so on vertex, 1.5–1.7 on scutum, 1.5 on midfemoral venter. Outer face of foretibia glabrous.

Gastral segments IV–VI red or more or less darkened. Legs black, inner face of foretibia brownish.

♂.—Clypeus (Fig. 146d): middle section closely punctate (in some specimens punctures sparse anteriorly); lip absent or inconspicuous; lateral corners of lobe distinct (prominent in some specimens), closer to orbits than to each other. Dorsal length of flagellomere I 1.5–1.9 × apical width. Vertex width 1.6–1.8 × length. Punctures shallow on frons, averaging less than one diameter apart (interspaces coarsely microsculptured); less than one to more than one diameter apart behind postocellar impression; less than one diameter apart on scutum; subcontiguous on mesopleuron anteriorly, more than one diameter apart posteriorly; no less than one diameter apart on mesothoracic venter. Apical depression of sterna II and III impunctate, glabrous, sterna IV–VI nearly so. Forefemoral notch glabrous. Foretarsal rake absent or rudimentary (rake spines of forebasitarsus equal to width of basitarsus or slightly longer); outer apical spine of foretarsomere II much shorter than tarsomere III. Length 5.5–8.5 mm.

Setae length (in MOD) 1.5–1.8 on vertex, 1.2–1.4 on scutum, about one on midfemoral venter, one on basal half of hindfemoral venter.

Gastral segments V–VII, or (some specimens) gaster all black. Legs black or (some individuals) tibiae partly and tarsi reddish.

Variation.—In West Indian females, the middle clypeal section may be smooth or microsculptured along the frontoclypeal suture, and the vertex and mesopleural punctation can be coarse or fine. In West Indian males, the glabrous area of the forefemoral notch may be small or large. See Pulawski (1974*a*) for details.

Life History.—Pulawski (1974*a*) noted an undetermined blattid nymph as prey of this species. Elliott et al. (1979) reported adults and nymphs of the roach *Symploce* sp. near *munda* Gurney as prey.

Geographic Distribution (Fig. 145).—Southern Florida and Caribbean Islands (Bahama Islands, Cuba, Dominican Republic, Jamaica, Puerto Rico, Virgin Islands).

Records and Material Examined (localities listed in Pulawski (1974*a*) are not repeated here).—UNITED STATES. FLORIDA: **Broward:** Dania, coast pine forest (6♀, 26♂; BMNH, USNM, WJP).

BAHAMA ISLANDS. **Eleuthera Island**: Rainbow Bay (1♀, 1♂, FSCA). **Great Sale Cay** (1♂, AMNH). **San Salvador** (Elliott et al. 1979).

DOMINICAN REPUBLIC (10♀, 71♂, CAS, FSCA, UCD). **Barahona**: Barahona (also 7 km E), Paraiso. **Distrito Nacional:** Haina, Santo Domingo (Jardín Botánico). **La Altagracia:** Boca de Yuma, Playa del Muerto E Nisibón. **Pedernales:** Cabo Rojo, Oviedo. **Puerto Plata**: Playa Cabarete (32 km E Puerto Plata). **Samana:** Honduras.

JAMAICA (9♀, 13♂; CAS, FSCA, IJ): **Hanover Parish:** Paradise. **Kingston Parish**: The Palisadoes. **Manchester Parish:** beach 15 km E Alligator Ponds. **St. Catherine Parish**: Port Henderson (also 7.5 air km SW). **St. Thomas Parish:** Mammee Bay, Yallahs.

julliani Species Group

Species of the *julliani* group have a truncate propodeum (hindface almost vertical), the apical sterna of males are glabrous (sparsely pruinose in some *coquilletti*), and the foretarsomeres are not expanded. In females of most species, the apical gastral segments have thickened preapical bristles (Fig. 147c, d), and the pygidial plate is either unusually broad (Fig. 147e) or has a distinctive sculpture. Members of the *albocinctus* group (which is not found in North and Central America) are similar, but their foretarsomeres I and II are expanded. I previously (Pulawski 1971) separated the *albocinctus* and *julliani* groups by the shape of the hindwing jugal lobe and inclination of crossvein cu-a, but subsequently (Pulawski 1977*a*) found that these features are intermediate in some Australian species. In other groups, the propodeum is either truncate or inclined and the male sterna are setose or fasciate, but glabrous in some species.

Species of the *julliani* group provision with mantids. The group occurs in the Palearctic, Afrotropical, Nearctic, and northern part of the Neotropical Region. Only two species are known in the New World: *cockerellae* and *coquilletti*.

Characters shared by *cockerellae* and *coquilletti* are: article V of maxillary palpus as long as IV; frons, scutum, and mesothoracic venter with well-defined, nearly contiguous punctures; mesopleuron and in some specimens scutum punctatorugose; propodeal dorsum microreticulate to irregularly rugose. Vestiture of gena, thorax, and femora not obscuring sculpture, but frontal integument hidden between antennal socket and orbit; setae appressed on scutum and mesothoracic venter; propodeal dorsum with setae directed posterad on lateral zone, directed anterad on mesal, triangular zone. Female: preapical setae of gastral segments thickened (especially on sterna IV and V); tergum V with a few, scattered punctures; pygidial plate (Fig. 147e) very broad, broadly rounded apically, smooth; venter of tarsomeres V with two or three spines (one basal, one apical); setae 1.0 MOD long on midfemoral venter; gaster red. Male: middle clypeal lobe almost flat; corners obtuse to rectangular, projecting over clypeal free margin (except in many *coquilletti*); distance between corner and orbit twice distance between corners; terga V and VI with impunctate apical depressions; punctures of tergum VII sparse basally, dense apically; sterna III–VI glabrous, impunctate or sparsely punctate (but sternum III or III and IV densely punctate laterally); forecoxa densely punctate; forefemoral notch deep, sharply delimited anteriorly and posteriorly; foretarsal rake present, apical spine of foretarsomere II slightly shorter to longer than foretarsomere III. Both *coquilletti* and *cockerellae* resemble the Old World species *julliani*, in which, however, the female pygidial plate has a transverse furrow, and the male clypeus and genitalia are different.

Among the New World species, females can be easily recognized as belonging to the *julliani* group by the broad pygidial plate (Fig. 147e) and thick gastral bristles (Fig. 147c, d). Males can be recognized by the following combination of characters: clypeal lobe narrow (Fig. 148a, b); vertex longer than wide; terga V and VI with glabrous, apical depressions; sterna III–VI impunctate or sparsely punctate, glabrous at least mesally; and the forefemoral notch sharply margined anteriorly and posteriorly (Fig. 148c, d; 150c), its surface is slightly raised above adjacent area. Some of these characters occur in many species belonging to other groups (e.g., the narrow vertex), and some are found in only a few other species. Similar terga and sterna are found in *menkei* and in *mirandus*, and the forefemoral notch is margined in some *iridipennis* and some *powelli*.

Tachysphex coquilletti Rohwer

(Figures 147–149)

Tachysphex coquilletti Rohwer, 1911:572, ♀, ♂.[1] Holotype: ♀, California: Los Angeles Co., no specific locality (USNM).—G. Bohart 1951:950; Krombein 1961:81, Kurczewski 1966*a*:317, Krombein 1967:393, Alcock and Gamboa 1975:164, Hurd and Linsley 1975:116, Bohart and Menke 1976:273, Krombein 1979:1632.

Tachysphex dentatus Williams, 1914:169, ♀.[1] Holotype: ♀, Kansas: Morton Co.: no specific locality (KU). Synonymized by G. Bohart 1951:950.—LaBerge 1956:527; Arnaud 1970:332.

Diagnosis.—*Tachysphex coquilletti* differs from *cockerellae*, its closest relative, in having appressed or nearly appressed vertex setae and the propodeal side unridged or weakly ridged. In

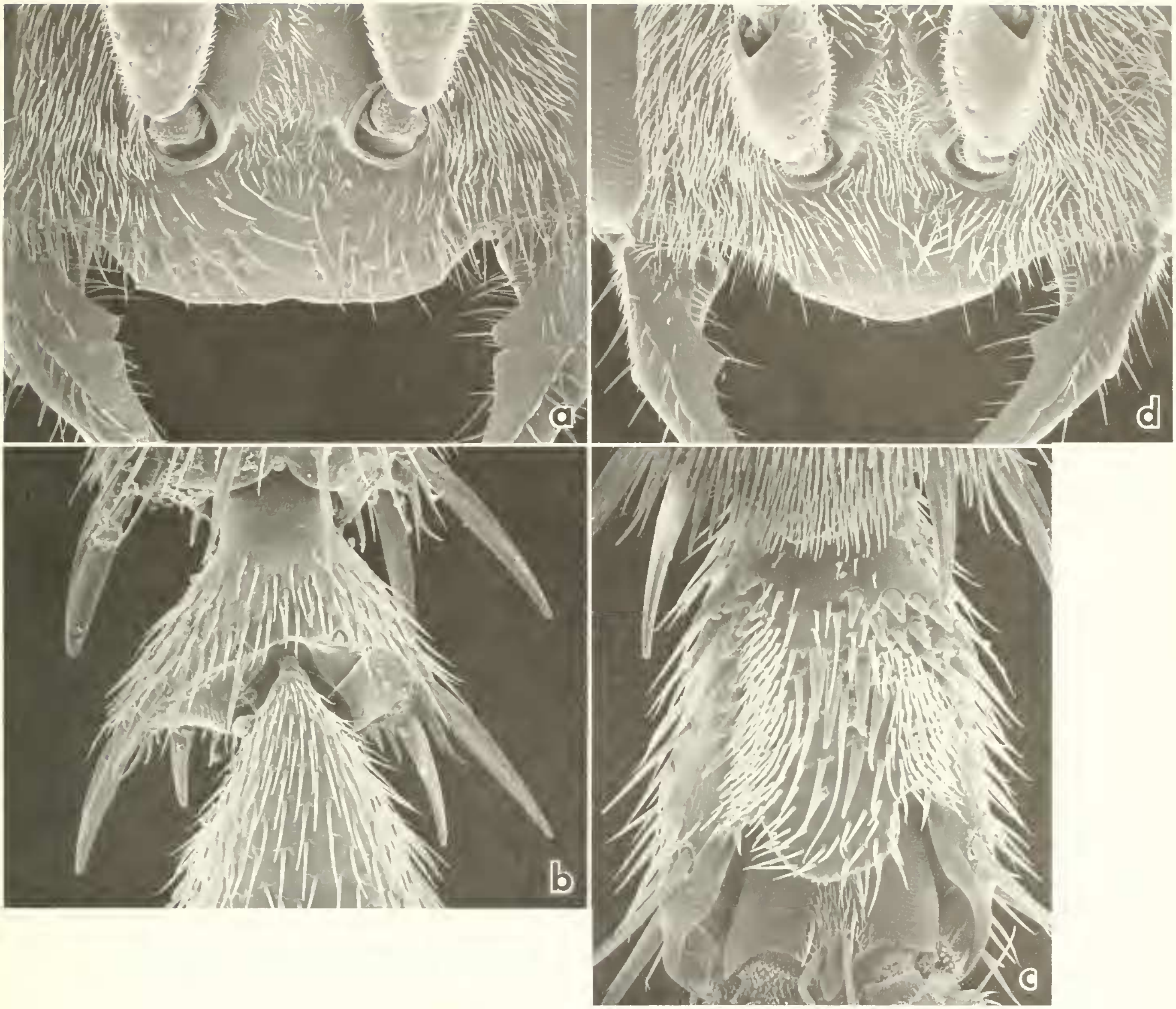

Figure 146. *Tachysphex alayoi* Pulawski: a—female clypeus; b—female hindtarsomere IV; c—female hindtarsomere V, ventral view; d—male clypeus.

the female, the clypeal lip is roundly swollen throughout (Fig. 147a, b); in the male, the gaster is dark apically, and the volsella is distinctive (Fig. 148f).

Description.—Vertex longer than wide or (some specimens) as long as wide. Propodeal side microareolate or finely ridged (only posteriorly so in male).

Vertex setae appressed or subappressed.

Head and thorax black, gastral segments I–IV (I–III in many females) silvery fasciate apically. Wings hyaline.

♀.—Clypeus (Fig. 147a, b): bevel shorter than basomedian area, roundly swollen throughout; lip with up to five obtuse teeth, but only median tooth distinct in some individuals. Vertex punctures less than one diameter apart. Length 6.5–9.5 mm.

Setae length 1.0 MOD on vertex, 1.5 MOD on lower gena.

Gaster red. Legs black, tarsi reddish; hindfemur and hindtibia red in some specimens, occasionally also part of midtibia.

♂.—Clypeus (Fig. 148a, b): bevel much shorter than basomedian area; lip with or without median tooth. Vertex indistinctly punctate, punctures less than one diameter apart. Forefemoral notch finely unevenly microrugose (Fig. 148c, e). Length 5–8 mm. Volsella: Figure 148f.

Setae length about 0.6 MOD on vertex, 1.0 MOD on lower gena.

Gastral segments I–III red, remainder brown. Legs black.

Life History.—Many specimens were collected on flowers of *Atriplex semibaccata* R. Br. by F. X. Williams at Chula Vista, California. Alcock and Gamboa (1975) observed a female performing an orientation flight, flying off, and coming back to the nest with an immature mantid, *Litaneutria minor* (Scudder). The nest was 12 cm long. The burrow ran in an arc just below the surface for the first 8 cm, and then it dropped sharply down to a cell 4 cm below the surface. The only previous prey record

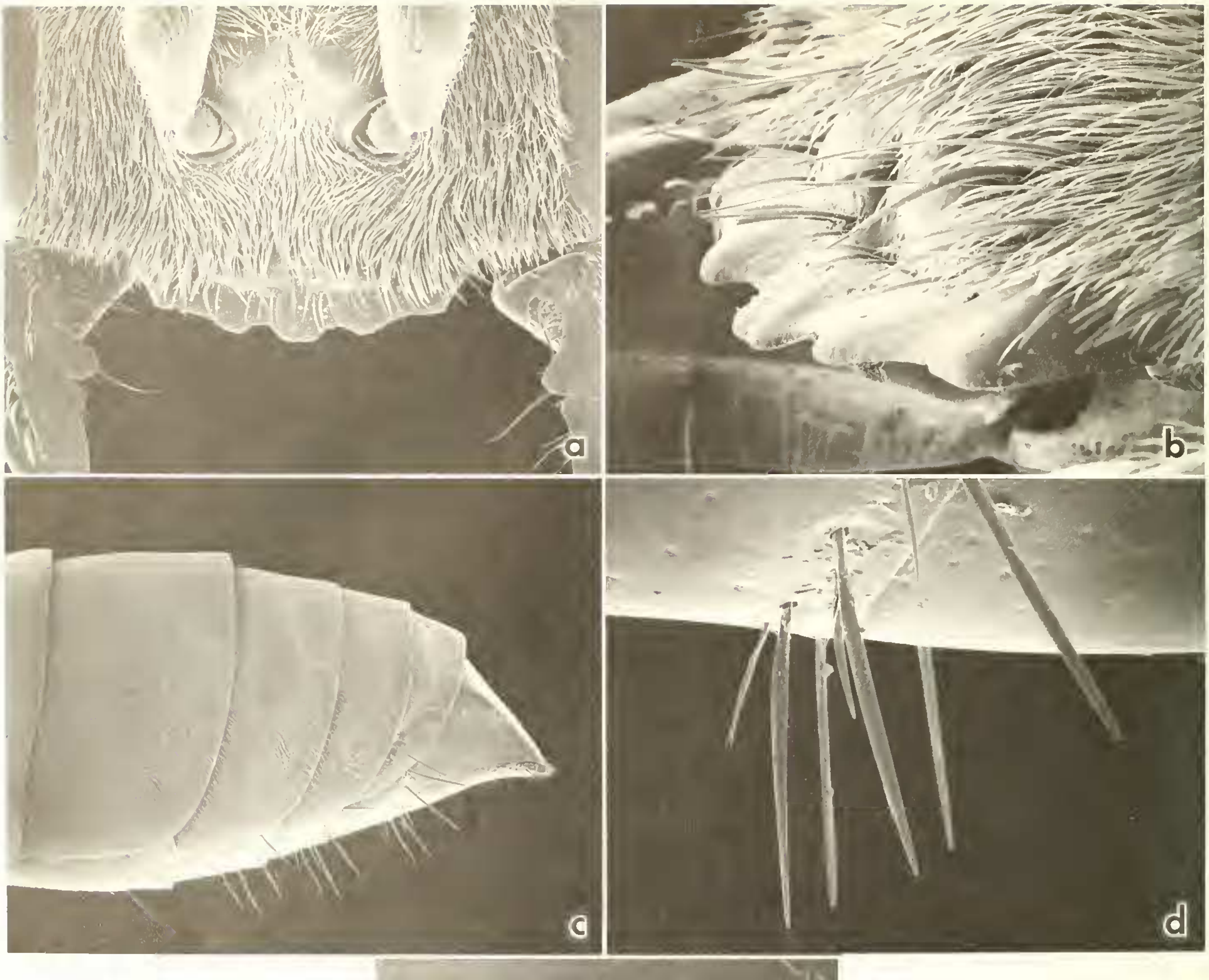

FIGURE 147 *Tachysphex coquilletti* (Rohwer), female: a—clypeus, front view; b—clypeus obliquely from the side; c—gaster; d—sternal setae; e—pygidial plate.

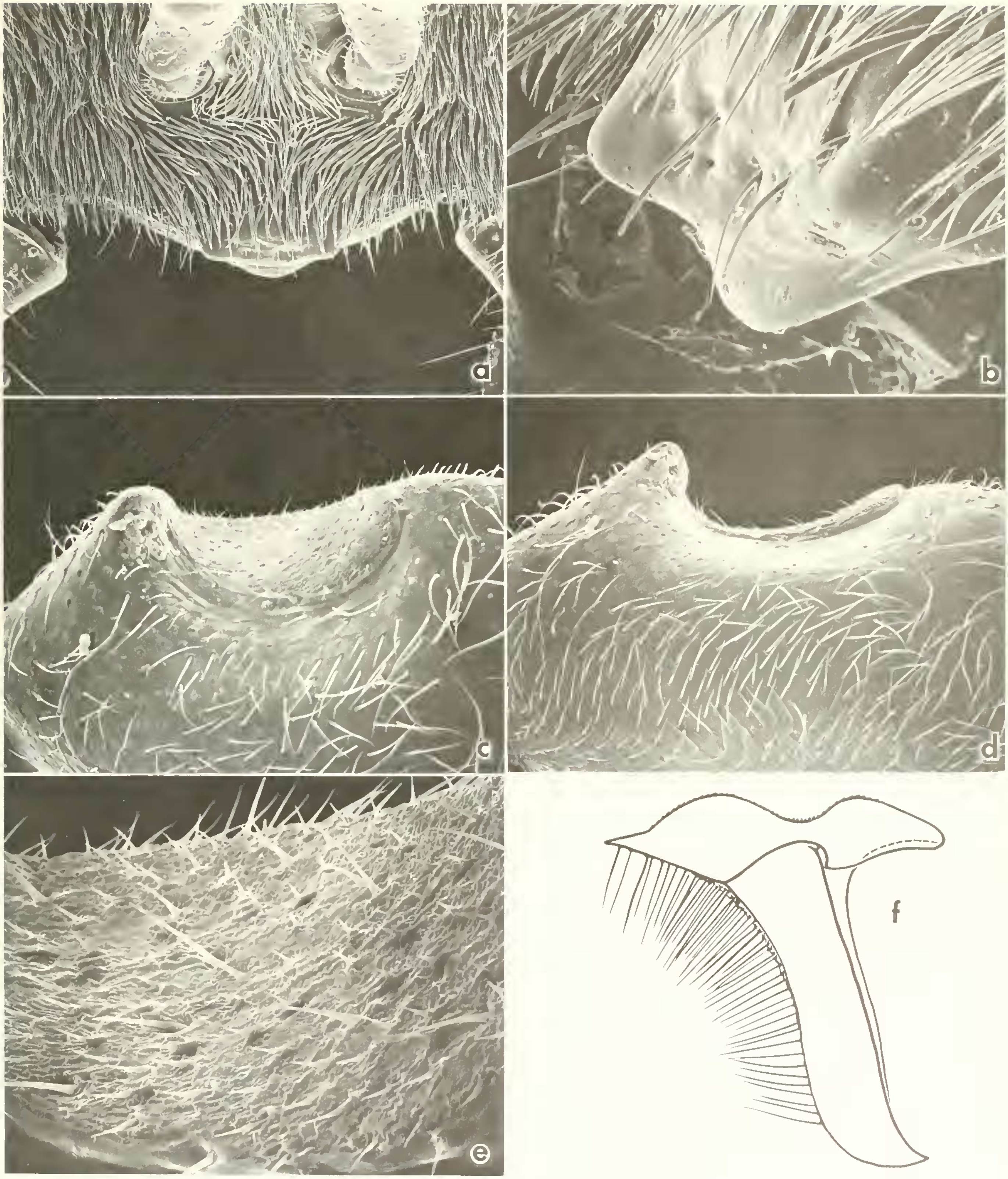

FIGURE 148. *Tachysphex coquilletti* Rohwer, male: a—male clypeus; b—clypeal lobe obliquely from the side; c—forefemoral notch; d—same in a different position; e—bottom of forefemoral notch; f—volsella.

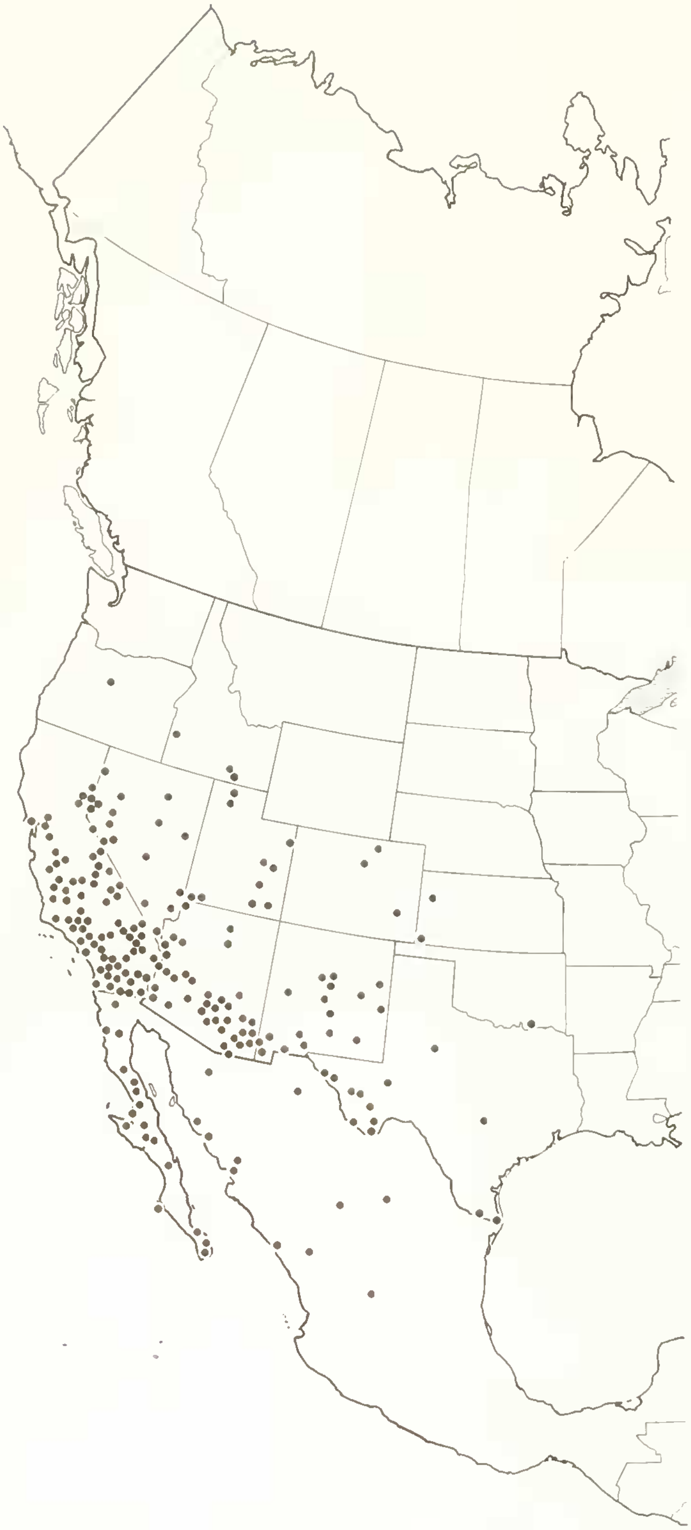

FIGURE 149. Geographic distribution of *Tachysphex coquilletti* Rohwer.

(G. Bohart 1951, as *tarsatus*, corrected by Kurczewski 1966*a*) was also a *Litaneutria*.

GEOGRAPHIC DISTRIBUTION (Fig. 149).—North America west of 95th meridian north to Kansas, Idaho, and Oregon; south to Tropic of Cancer.

MATERIAL EXAMINED.—665♀, 658♂.

RECORDS.—UNITED STATES: ARIZONA. **Cochise. Coconino:** 20 mi N Flagstaff, The Gap. **Gila:** Cedar Creek (15 mi W Fort Apache), 3 mi SE Christmas. **Graham:** 6 mi S Safford (also 16 mi E). **Maricopa. Mohave. Pima. Pinal. Santa Cruz:** Patagonia, Santa Rita Mts. **Yavapai:** 20 mi NW Wickenburg. **Yuma.** CALIFORNIA. **Alameda:** 10 mi E Livermore, Tesla Road. **Contra Costa:** Antioch. **Fresno. Imperial. Inyo. Kern. Kings:** Avenal, Lemoore. **Lassen:** Hallelujah Junction, Hot Spring Mt. **Los Angeles. Marin:** Ross. **Merced:** Dos Palos. **Mono:** 11 mi N Bridgeport. **Monterey:** 10 mi N Parkfield. **Orange:** Anaheim, Irvine Park, Potrero Canyon. **Plumas:** Beckwourt Summit. **Riverside. San Benito:** Clear Creek Recreation Area, Panoche. **San Bernardino. San Diego. San Luis Obispo:** 5 mi S Creston. **Santa Barbara:** Bluff Camp (San Rafael Mts.). **Sierra:** Sierraville. **Stanislaus:** Patterson. **Tulare:** Goshen Junction, Woodlake. **Ventura:** Hungry Valley (5 mi S Gorman), Lockwood Valley, Quatal Canyon (NW corner of county). **Yolo:** Davis, Woodland. COLORADO: **Bent:** 2 mi S Hasty. **Boulder:** Boulder. **Weld:** Crow Valley grassland area, Owl Creek (12 mi NE Nunn). IDAHO: **Cassia:** 4 mi SE Malta. **Owynza:** Murphy. **Oneida:** Curlew Reservoir. KANSAS: **Morton:** —. **Wallace:** Sharon Springs. NEVADA. **Churchill:** Fallon. **Clark:** Juanita Spring Ranch (10 mi S Riverside), Moapa, 10 mi S Searchlight. **Eureka:** 6 mi S Beowawe, 14 mi W Eureka. **Lincoln:** Tule Desert (E Carp). **Mineral:** 8 mi S Mina, 10 mi W Montgomery Pass, 4.5 mi S Schurz. **Nye:** Mercury, 13 mi W Warm Springs. **Pershing:** Lovelock (also 8 mi S). **Washoe:** Hwy. 81 (54 mi NW Gerlach), Pyramid Lake (S shore), Reno. **White Pine:** Charcoal Oven State Park, Connor Pass. NEW MEXICO. **Bernalillo:** Albuquerque. **Catron:** Pie Town. **De Baca:** Sumner Lake State Park. **Dona Ana:** Hatch, Las Cruces, Mesilla Park. **Eddy:** 15 mi E Hope. **Hidalgo. Lincoln:** Carizzozo. **Luna:** Columbus. **Otero:** Alamo Canyon near Alamogordo. **Quay:** Tucumcari. **Roosevelt:** Portales. **Torrance:** Estancia, Moriarty, Gran Quivara (town). OKLAHOMA. **Marshall:** Lake Texoma (2 mi E Willis). OREGON: **Deschutes:** Smith Rock State Park. TEXAS: **Brewster:** Alpine, Big Bend National Park (Boquillas, Grapevine Spring, Nine Point Draw, Panther Junction, Santa Elena Canyon), 34 mi S Marathon. **Cameron:** Port Isabel. **Guadalupe:** Seguin. **Hidalgo:** McAllen Botanical Garden. **Hudspeth:** McNary, 5 mi E Sierra Blanca. **Jeff Davis:** 23 mi W Fort Davis, Valentine. **Mitchell:** Lake Colorado City State Park. **Presidio:** Presidio. **Starr:** Rio Grande City. **Ward:** 1 mi S Grandfalls. UTAH: **Box Elder:** 13 mi W Lakeside, 25 mi SW Snowville. **Emery:** 9 air mi E Castledale, Green River, Wild Horse Creek N Goblin Valley. **Garfield:** Shootaring Canyon. **San Juan:** 6 mi S Hall's Crossing, Kane Springs (E Natural Bridges National Monument). **Uintah:** SW Bonanza. **Washington.**

MEXICO: **Baja California Norte. Baja California Sur. Chihuahua:** 12 mi N Escalón, 10 km S Villa Ahumada. **Coahuila:** 10 km SW Cuatrociénegas. **Durango:** 5 mi W Durango. **Sinaloa:** 8 mi SE Elota. **Sonora:** Alamos (also 10 mi SE), Bahía San Carlos, Cócorit, 19 mi S Estación Llano, Guaymas, 8 mi S Santa Ana, 15 mi E Yavaros. **Zacatecas:** 9 mi N Ojo Caliente.

Tachysphex cockerellae Rohwer

(Figures 150, 151)

Tachysphex cockerellae Rohwer, 1914:518, ♂. ! Holotype: ♂, Guatemala: Amatitlán (USNM).—Krombein 1967:393, Pulawski 1974*a*:88, Bohart and Menke 1976: 273, Krombein 1979:1632, Elliott and Kurczewski 1985:296.

DIAGNOSIS.—*Tachysphex cockerellae* differs from its closest relative *coquilletti* in having erect vertex setae and a ridged propodeal side (not ridged in some males). The clypeal bevel of the female is ridgelike, overhanging the lip base laterally (Fig. 150a, d), and the vast majority of males have an all red gaster.

DESCRIPTION.—Propodeal side ridged, but ridges evanescent in occasional males.

Vertex setae erect, 1.0 MOD long.

Head, thorax, and legs black, tarsi reddish or (most males) black. Gaster red in most specimens, but abdomen largely darkened in a male from Wagon Road No. 2 Campground, California

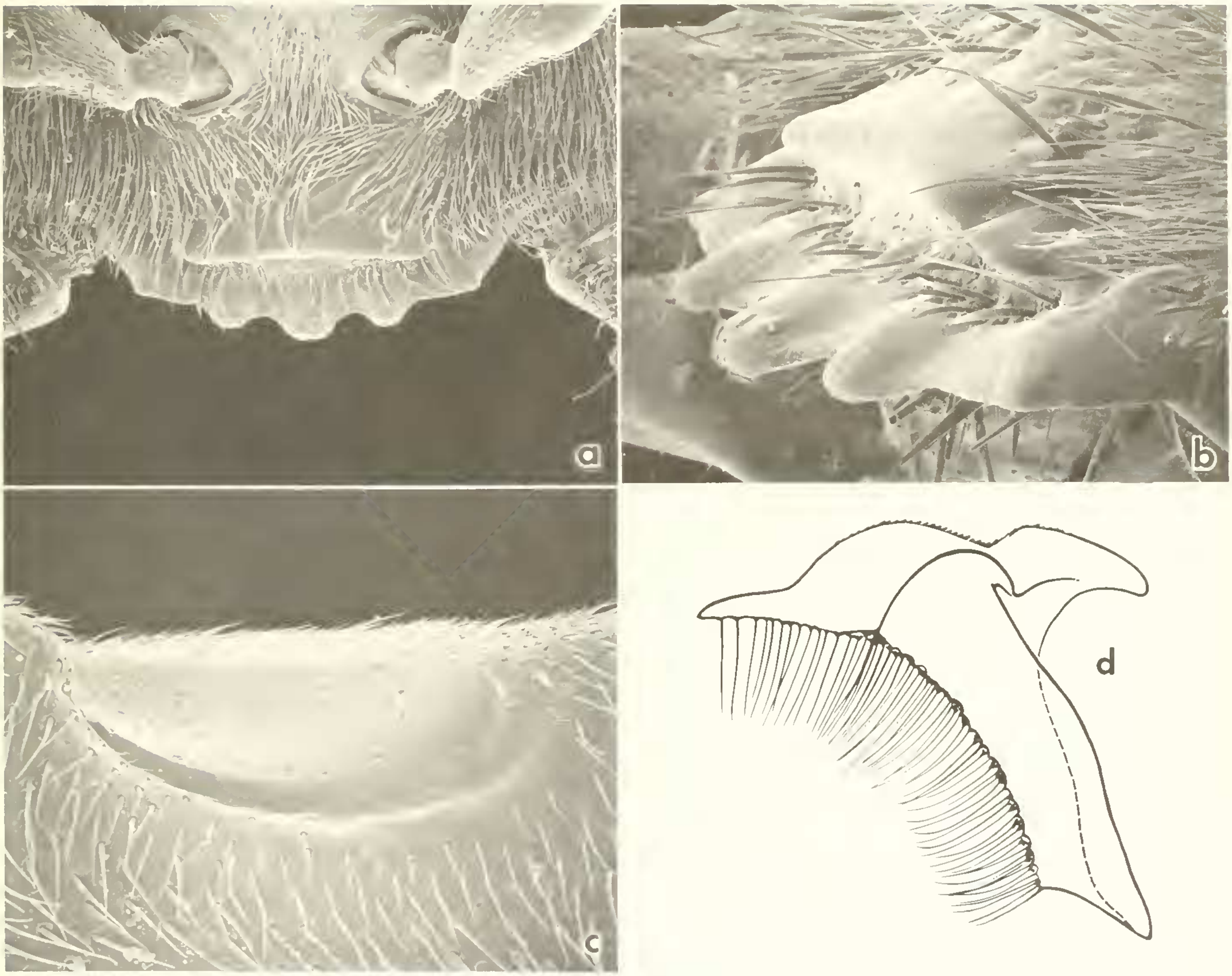

FIGURE 150. *Tachysphex cockerellae* Rohwer: a—clypeus of female; b—clypeus of female obliquely from the side; c—forefemoral notch of male; d—volsella.

(CAS). In this specimen, all sterna are black (except sternum II red laterally), and terga IV–VII are blackish. Terga I–IV (I–V in many males) silvery fasciate apically. Wings hyaline.

♀.—Clypeus (Fig. 150a, b): bevel shorter than basomedian area, ridgelike, especially laterally where it overhangs base of lip; lip with three to five obtuse teeth or (some specimens) only one distinct tooth (median or lateral). Vertex as long as wide or slightly longer, with well-defined punctures that are no more than one diameter apart. Length 8–12 mm.

♂.—Clypeus: bevel much shorter than basomedian area to almost absent; lip usually with median tooth. Vertex longer than wide, its punctures less than one to more than one diameter apart. Forefemoral notch micropunctate (Fig. 150c). Length 7.9–9.8 mm.

LIFE HISTORY.—A female from Napa County, California, is pinned with a nymphal mantid *Litaneutria minor* (Scudder) according to Elliott and Kurczewski (1985).

GEOGRAPHIC DISTRIBUTION (Fig. 151).—Southern Oregon to northern Colombia, eastward to New Mexico and southwestern Texas, also southwestern Utah.

MATERIAL EXAMINED.—448♀, 547♂.

RECORDS.—UNITED STATES ARIZONA. **Cochise. Gila:** 3 mi SW Christmas. **Graham:** Roper Lake State Park. **Maricopa:** 3.5 mi S Cave Creek, Phoenix, 3 mi SW Wickenburg. **Mohave:** Cattail Cove (9 mi N Parker Dam), Mohave Valley **Pima. Pinal:** Oracle (also 3 mi SW), 3 mi W Superior. **Santa Cruz. Yavapai:** Prescott. **Yuma:** Parker, Quartzsite, Tinajas Altas. CALIFORNIA **Alameda:** Tesla Road **Calaveras:** Mokelumne Hill. **Colusa:** Lagoda, 10 mi SW Stonyford. **Contra Costa:** Mt. Diablo. **Fresno:** 8 mi NW Coalinga. **Imperial. Inyo:** 7 mi N Parcher's Camp (ca. 14 mi W Big Pine). **Kern:** Antelope Canyon near Tehachapi, Mill Potrero, Walker Pass. **Los Angeles. Modoc:** Alturas. **Mono:** 2.5 mi S Bridgeport 1 mi SW Tom's Place, Topaz Lake. **Napa:** —(August 1898). **Riverside. San Bernardino:** Miller Canyon, Needles. **San Diego:** Borrego Valley, Scissors Crossing, Vallecitos. **Santa Barbara:** Bluff Camp, Figueroa Mts., Santa Ynez Mts. **Santa Clara:** Arroyo Mocho (25 mi S Livermore). **Shasta:** Old Station, 10 mi N Redding. **Sierra:** Sierraville. **Siskiyou:** Klamath River 8 mi N Yreka **Stanislaus:** Del Puerto Canyon. **Tehama:** Manton. **Tulare:** Ash Mountain (Kaweah Power Station). **Tuol-**

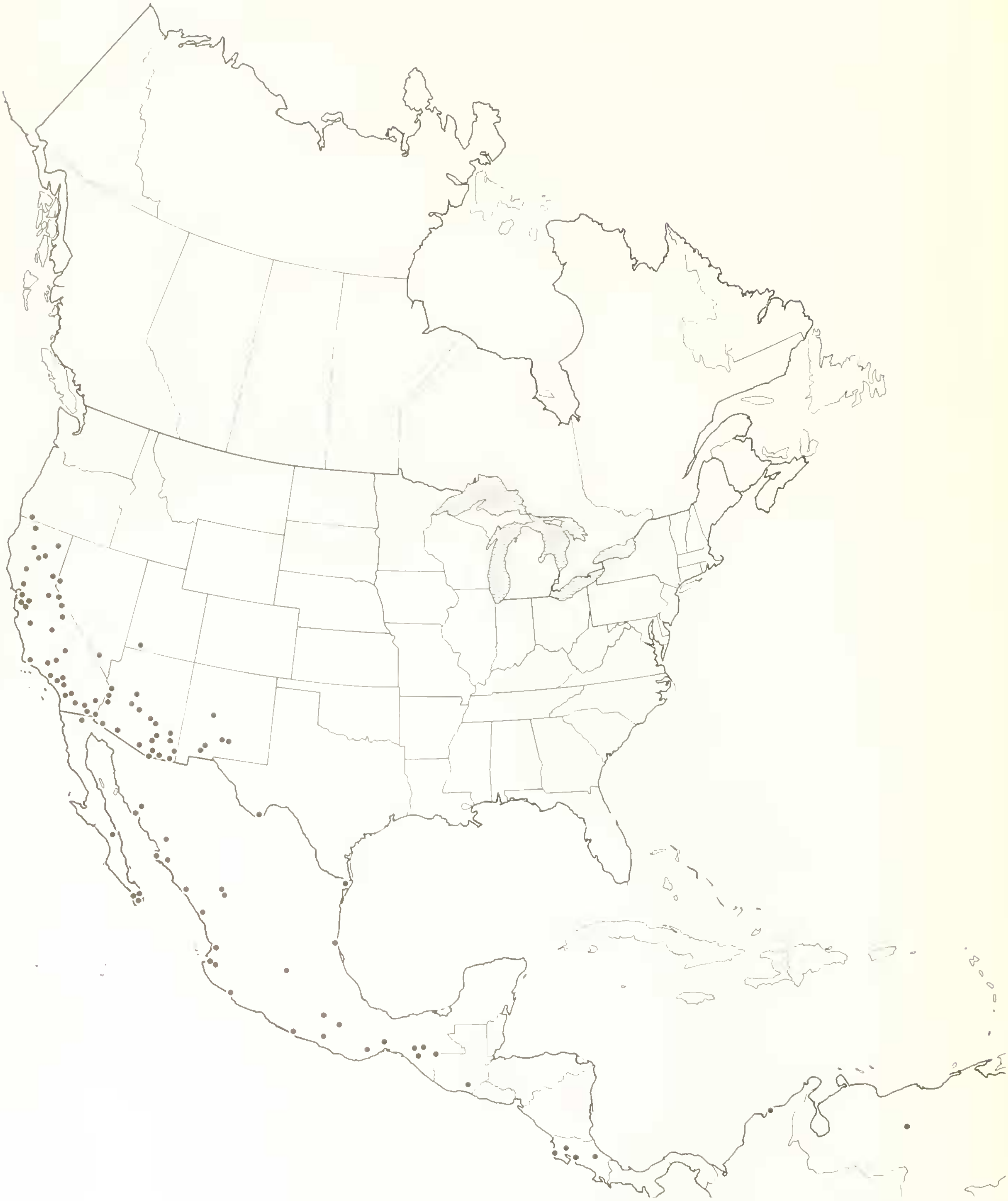

FIGURE 151. Geographic distribution of *Tachysphex cockerellae* Rohwer.

umne: 6 mi E Tuolumne City. **Ventura:** Wagon Road No. 2 Campground (18 air mi WSW Gorman). NEVADA: **Clark:** Charlestown Mts. (Willow Creek Camp), Mt. Springs Summit. **Washoe:** Galena Creek, Mt. Rose. NEW MEXICO: **Luna:** 6 mi NW Florida. **Otero:** Alamogordo, Cloudcroft. **Sierra:** Percha Dam State Park. **Socorro:** Bernardo, La Joya (20 mi N Socorro). OREGON: **Josephine:** Rough and Ready Botanical Wayside 5 mi S Cave Junction (LACM). TEXAS: **Brewster:** Big Bend National Park (Santa Elena Canyon). UTAH. **Washington:** Leeds Canyon, Zion National Park.

MEXICO: **Baja California Norte:** 10 mi S Mexicali. **Baja California Sur:** El Pescadero, Los Barriles, Miraflores (4 mi WSW), 35 km S Mulegé, 10 mi N San Lucas. **Chiapas:** 5 mi E Cintalapa, 18 km S La Trinitaria, Tuxtla Gutiérrez, Villa Flores. **Colima:** Rio Salado 7 km S Colima. **Durango:** 5 mi W Durango, 4 mi N Nombre de Dios. **Guerrero:** 8 mi N Chilpancingo, Zihuatenejo. **Jalisco:** Plan de Barrancas, Puerto Vallarta. **Morelos:** 3 mi N Alpuyeca, 5 mi E Cuernavaca, Lake Tequesquitengo. **Nayarit:** 13 mi SW Tepic. **Oaxaca:** 23 mi S Matias Romero, 62 mi W Tehuantepec. **Puebla:** 3 mi NW Petlalcingo (also 3 mi SE). **Queretaro:** 12 mi NW Querétaro. **Sinaloa:** 10 mi W Concordia, 3 and 8 mi N Elota, 54 mi S Culiacán, 14 mi S Los Mochis, Playa Baviri (17 mi W Los Mochis). **Sonora:** La Aduana, Alamos, Bahía San Carlos, Cócorit, Guaymas. **Tamaulipas:** Matamoros, Tampico.

CENTRAL AND SOUTH AMERICA. COSTA RICA: Cordillera de Guanacasta, Junquillal beach, Puntarenas, Rio Corbici near Cañas, 4 km W Turrialba GUATEMALA. Amatitlán. COLOMBIA **Atlantico Prov.:** Barranquilla. VENEZUELA: **Guarico Prov.:** Rio Orituco 15 km S Calabozo.

LITERATURE CITED

Alcock, J. 1973. Notes on a nesting aggregation of digger wasps in Seattle, Washington (Hymenoptera). Wasmann J. Biol. 31:323–336.

Alcock, J. and G. J. Gamboa. 1975. The nesting behavior of some sphecid wasps of Arizona, including *Bembix*, *Microbembex*, and *Philanthus*. J. Arizona Acad. Sci. 10:160–165.

Arnaud, P. H., Jr. 1970. List of the scientific publications and insect taxa described by Francis Xavier Williams (1882–1967). Occas. Pap. California Acad. Sci. 80:1–33, photograph.

Arnold, G. 1923. The Sphecidae of South Africa. Part II. Ann. Transvaal Mus. 9:143–190, pl. V.

———. 1945 (1944). The Sphecidae of Madagascar. Cambridge University Press, Cambridge. 193 pp.

Ashmead, W. H. 1890. On the Hymenoptera of Colorado, descriptions of new species, notes, and a list of the species found in the state. Bull. Colorado Biol. Assoc. 1:1–47.

———. 1894. The habits of the aculeate Hymenoptera. Psyche 7:19–26, 39–46, 59–66, 75–76.

———. 1899. Classification of the entomophilous wasps, or the superfamily Sphegoidea. Canad. Entomol. 3:145–155, 161–174, 212–225, 238–251, 291–300, 322–330, 345–357.

Banks, N. 1921. New Nearctic fossorial Hymenoptera. Ann. Entomol. Soc. America 14:16–26.

Bingham, C. T. 1897. Hymenoptera.—Vol. I. Wasps and bees. *In* Fauna of British India, including Ceylon and Burma. W. T. Blanford, ed. Taylor and Francis, London. XXIX + 579 pp.

Bohart, G. E. 1951. Tribe Tachytini. Pp. 945–953 *in* Hymenoptera of America north of Mexico. Synoptic catalog. C. F. W. Muesebeck, K. V. Krombein, and H. K. Townes, eds. United States Department of Agriculture, Washington, D.C. 1,420 pp., 1 map.

Bohart, R. M. 1962. New species of black *Tachysphex* from North America (Hymenoptera, Sphecidae). Proc. Biol. Soc. Washington 75:33–40.

Bohart, R. M. and A. S. Menke. 1976. Sphecid wasps of the world. A generic revision. University of California Press, Berkeley, Los Angeles, London. 1 color plate, IX + 695 pp.

Bradley, J. C. 1928. Order Hymenoptera. Pp. 870–1033 *in* A list of the insects of New York with a list of spiders and certain other allied groups. M. D. Leonard, ed. Cornell University, Ithaca, New York. 1,121 pp.

Bridwell, C. S. 1899. A list of Kansas Hymenoptera. Trans. Kansas Acad. Sci. 16:203–216.

Brimley, C. S. 1938. The insects of North Carolina being a list of the insects of North Carolina and their close relatives. North Carolina Department of Agriculture, Raleigh, North Carolina. 560 pp.

Britton, W. E. 1920. Check-list of the insects of Connecticut. Bull. Connecticut State Geol. Nat. Hist. Survey 31:1–397.

Britton, W. E. and L. O. Howard. 1921. William Hampton Patton. Entomol. News 32:33–40, 1 pl.

Cameron, P. 1888–1900. Biologia Centrali-Americana. Insecta. Hymenoptera (Fossores). Vol. II. Taylor and Francis, [London]. i–xi + 413 pp., pl. 1–14.

Cockerell, T. D. A. 1900 (1897–1899). Contributions to the entomology of New Mexico. I. A catalogue of the fossorial Hymenoptera of New Mexico. Proc. Davenport Acad. Sci. 7:139–156.

Cooper, K. W. 1953. The wasps of Penikese Island, Buzzards Bay, Massachusetts (Hymenoptera). Entomol. News 64:29–36.

Cresson, E. T. 1862–1863. A catalogue of the described species of several families of Hymenoptera inhabiting North America. Proc. Entomol. Soc. Philadelphia 1:202–211, 227–238 (1862), 316–344 (1863).

———. 1865. Catalogue of Hymenoptera in the Collection of the Entomological Society of Philadelphia, from Colorado Territory. Proc. Entomol. Soc. Philadelphia 4:242–313, 426–488.

———. 1872. Hymenoptera Texana. Trans. Amer. Entomol. Soc. 4:153–292.

———. 1876. List of Hymenoptera, collected by J. Duncan Putnam, of Davenport, Iowa, with descriptions of two new species. Proc. Davenport Acad. Sci. 1:206–211, pl. XXXV.

———. 1916. The Cresson types of Hymenoptera. Mem. Amer. Entomol. Soc. 1:1–141.

———. 1928. The types of Hymenoptera in the Academy of Natural Sciences of Philadelphia other than those of Ezra T. Cresson. Mem. Amer. Entomol. Soc. 5:1–90.

Dahlbom, A. G. 1832. Exercitaciones Hymenopterologicae ad illustrandam faunam Svecicam, quas venia ampliss. Facultatis Philos. Acad. Lund. proponunt Gustav. Dahlbom, Historiae Natur. Doc., Societ. Linn. Holm. Membr., et N. P. Ringstrand, Ostro-gothi. In Acad. Carolina die XXVII Octobris MDCCCXXXII. Part. IV. Londini Gothorum. Pp. 49–64.

———. 1839–1840. Synopsis Hymenopterologiae Scandinavicae. Skandinaviska Steklarnes Natur-Historia med figurer målade after naturen och ritade på sten af J. Ahlgren. Andra kretsen: rof-steklar och deras likar. 1:sta häftet. Första afdelningen: Naturhistorisk undersökning om skandinaviska Gull- och Silvermunsteklar. Examen historico-naturale de Crabronibus Scandinavicis. Lund. Pp. [1–4], 1–104, 5 pl.

Dalla Torre, C. G. de. 1897. Catalogus Hymenopterorum hucusque descriptorum systematicus et synonymicus. Volumen VIII. Fossores (Sphegidae). Guilelmi Engelmann, Lipsiae. 749 pp.

de Beaumont, J. 1936. Les *Tachysphex* de la faune française (Hym. Sphecidae). Ann. Soc. Entomol. France 105:177–212.

———. 1940. Les *Tachysphex* de la faune égyptienne (Hymenoptera: Sphecidae). Bull. Soc. Fouad Ier Entomol. 24:153–179.

———. 1947*a*. Nouvelle étude des *Tachysphex* de la faune égyptienne. Bull. Soc. Fouad Ier Entomol. 31:141–216.

———. 1947*b*. Contribution a l'étude du genre *Tachysphex* (Hym. Sphecid.). Mitt. Schweiz. Entomol. Ges. 20:661–677.

———. 1960. Sphecidae de l'île de Rhodes (Hym.). Mitt. Schweiz. Entomol. Ges. 33:1–26.

Elliott, N. B. and F. E. Kurczewski. 1973. Northern distribution records for several Sphecidae and Pompilidae (Hymenoptera). J. New York Entomol. Soc. 81:79–80.

———. 1974. Character displacement in *Tachysphex terminatus* and *T. similis* (Hymenoptera: Sphecidae, Larrinae). Ann. Entomol. Soc. America 67:725–727.

———. 1975 (1974). Seasonal variation in *Tachysphex terminatus* (Smith) (Hymenoptera: Sphecidae, Larrinae). J. New York Entomol. Soc. 82:268–270.

———. 1978. Geographic variation in *Tachysphex terminatus* (Hymenoptera: Sphecidae, Larrinae). Proc. Entomol. Soc. Washington 80:103–112.

———. 1985. Nesting and predatory behavior of some *Tachysphex* from the western United States (Hymenoptera: Sphecidae). Great Basin Naturalist 45:293–298.

Elliott, N. B., F. E. Kurczewski, S. Claflin, and P. Salbert. 1979. Preliminary annotated list of the wasps of San Salvador Island, the Bahamas, with a new species of *Cerceris* (Hymenoptera: Tiphiidae, Scoliidae, Vespidae, Pompilidae, Sphecidae). Proc. Entomol. Soc. Washington 8:352–365.

Evans, H. E. 1958. Studies on the larvae of digger wasps (Hymenoptera, Sphecidae). Part IV: Astatinae, Larrinae, and Pemphredoninae. Trans. Amer. Entomol. Soc. 84:109–139, pl. II–VIII.

———. 1962. The evolution of prey-carrying mechanism in wasps. Evolution 16:468–483.

———. 1964. Further studies on the larvae of digger wasps (Hymenoptera, Sphecidae). Trans. Amer. Entomol. Soc. 90:235–299.

———. 1970. Ecological-behavioral studies on the wasps of Jackson Hole, Wyoming. Bull. Mus. Compar. Zool. 140:451–511.

———. 1973. Further studies on the wasps of Jackson Hole, Wyoming (Hymenoptera, Aculeata). Great Basin Nat. 33:147–155.

Evans, H. E., R. W. Matthews, and W. Pulawski. 1976. Notes on the nests and prey of four Australian species of *Tachysphex* Kohl, with description of a new species (Hymenoptera: Sphecidae). J. Austral. Entomol. Soc. 15:441–443.

Ferguson, W. E. 1962. Biological characteristics of the mutillid subgenus *Photopsis* Blake and their systematic values (Hymenoptera). Univ. California Publ. Entomol. 27:1–92.

Finnamore, A. T. 1982. The Sphecoidea of southern Quebec (Hymenoptera). Lyman Entomol. Mus. Res. Lab. Mem. 11. 348 pp.

Fox, W. J. 1891. Hymenopterological notes. I. Entomol. News 2:194–196.

———. 1892. Monograph of the North American species of *Tachytes*. Trans. Amer. Entomol. Soc. 19:234–252.

———. 1893. New North American aculeate Hymenoptera. J. New York Entomol. Soc. 1:53–56.

———. 1894*a* (1893). The North American Larridae. Proc. Acad. Nat. Sci. Philadelphia 1893:467–551.

———. 1894*b*. Second report on some Hymenoptera from Lower California, Mexico. Proc. California Acad. Sci. (2)4:92–121.

———. 1902. A note of the insect collection of Thomas Say. Entomol. News 13:11–12.

Fullaway, D. T., and N. L. H. Krauss. 1945. Common insects of Hawaii. Honolulu, Hawaii. 228 pp., pl. I–XII.

Gahan, A. B., and S. A. Rohwer. 1917–1918. Lectotypes of the species of Hymenoptera (except Apidae) described by Abbe Provancher. Canad. Entomol. 49(1917):298–308, 331–336, 391–400, 427–433; 50(1918):28–33, 101–106, 133–137, 166–171, 196–201.

Gess, F. W. 1978. Ethological notes on *Holotachysphex turneri* (Arnold) (Hymenoptera: Sphecidae: Larrinae) in the eastern Cape Province of South Africa. Ann. Cape Prov. Mus. (Nat. Hist.) 11:209–215.

———. 1980. Ethological notes on *Kohliella alaris* Brauns (Hymenoptera: Sphecidae: Larrinae) in the eastern Cape Province of south Africa. Ann. Cape Prov. Mus. (Nat. Hist.) 13:45–54.

———. 1981. Some aspects of an ethological study of the aculeate wasps and the bees of a karroid area in the vicinity of Grahamstown, South Africa. Ann. Cape Prov. Mus. (Nat. Hist.) 14:1–80.

Harrington, W. H. 1902. Fauna Ottawaensis. Hymenoptera—Superfamily II.—Sphegoidea. Ottawa Nat. 15:215–224.

Hartman, C. 1905. Observations on the habits of some solitary wasps of Texas illustrated with original photographs taken in the field. Bull. Univ. Texas, Sci. Ser. No. 6. Pp. 1–72, pl. I–IV + [1].

Hurd, P. D., and E. G. Linsley. 1975. Some insects other than bees associated with *Larrea tridentata* in the southwestern United States. Proc. Entomol. Soc. Washington 77:100–120.

Jorgensen, P. 1912. Los Crisididos y los Himenopteros Aculeatos de la provincia Mendoza. Anal. Mus. Nac. Hist. Nat. Buenos Aires 22:267–338.

Kirby, W. F. 1890. Insecta, excepting Coleoptera. Pp. 530–548 *in* H. N. Ridley, Notes on the zoology of Fernando Noronha. J. Linn. Soc. Zool. 20:473–592.

Kohl, F. F. 1880. Die Raubwespen Tirol's nach ihrer horizontalen und verticalen Verbreitung, mit einem Anhange biologischer und kritischer Notizen. Z. Ferdinandeums Innsbruck 3(24):97–242.

———. 1883. Über neue Grabwespen des Mediterrangebietes. Deutsche Ent. Z. 27:161–186.

———. 1884 (1883). Neue Hymenopteren in den Sammlungen des k. k. zool. Hof-Cabinetes zu Wien. Verh. Zool. Bot. Ges. Wien 33:331–386, pl. XVIIa–XVIII.

———. 1885 (1884). Die Gattungen und Arten der Larriden Autorum [sic]. Verh. Zool. Bot. Ges. Wien 34:171–267, pl. VIII–IX, 327–454, pl. XI–XII.

———. 1892. Neue Hymenopterenformen. Ann. Naturhist. Hofmus. 7:197–234, pl. XIII–XV.

Krombein, K. V. 1938. Descriptions of four new wasps (Hymenoptera: Sapygidae, Sphecidae). Ann. Entomol. Soc. America 31:467–470.

———. 1939. Descriptions and records of new wasps from New York state (Hym.: Sphecidae). Bull. Brooklyn Entomol. Soc. 34:135–144.

———. 1950 (1949). An annotated list of wasps from Nags Head and the Kill Devil Hills (Hymenoptera: Aculeata). J. Elisa Mitchell Sci. Soc. 65:262–272.

———. 1951. Wasp visitors of tulip-tree honeydew at Dunn Loring, Virginia (Hymenoptera: Aculeata). Ann. Entomol. Soc. America 44:141–143.

———. 1952. Preliminary annotated list of the wasps of Westmoreland State Park, Virginia, with notes on the genus *Thaumatodryinus* (Hymenoptera: Aculeata). Trans. Amer. Entomol. Soc. 78:89–100.

———. 1953*a* (1952). Biological and taxonomic observations on the wasps in a coastal area of North Carolina (Hymenoptera: Aculeata). Wasmann J. Biol. 10:257–341.

———. 1953*b*. Kill Devil Hills wasps, 1952. Proc. Entomol. Soc. Washington 55:113–135.

———. 1953*c*. The wasps and bees of the Bimini Island group, Bahamas, British West Indies (Hymenoptera: Aculeata). Amer. Mus. Novit. No. 1633:1–29.

———. 1958*a*. Additions during 1956 and 1957 to the wasp fauna of Lost River State Park, West Virginia, with biological notes and descriptions of new species (Hymenoptera, Aculeata). Proc. Entomol. Soc. Washington 60:49–64.

———. 1958*b*. Biological notes on some wasps from Kill Devil Hills, North Carolina, and additions to the faunal list (Hymenoptera, Aculeata). Proc. Entomol. Soc. Washington 60:97–110.

———. 1958*c*. Superfamily Sphecoidea. Pp. 186–204 *in* Hymenoptera of America north of Mexico. Synoptic catalog (Agricultural Monograph No. 2). First Supplement. K. V. Krombein, ed. United States Department of Agriculture, Washington, D.C. 305 pp.

———. 1961. Some insect visitors of mat *Euphorbia* in southeastern Arizona (Hymenoptera, Diptera). Entomol. News 72:80–83.

———. 1963*a*. A new *Tachysphex* from southeastern United States (Hymenoptera, Sphecidae). Entomol. News 74:177–180.

———. 1963*b*. Natural history of Plummers Island, Maryland. XVII. Annotated list of the wasps (Hymenoptera: Bethyloidea, Scolioidea, Vespoidea, Pompiloidea, Sphecoidea). Proc. Biol. Soc. Washington 76:255–280.

———. 1964. Results of the Archbold Expeditions. No. 87. Biological notes on some Floridan Wasps (Hymenoptera, Aculeata). Amer. Mus. Novit. No. 2201:1–27.

———. 1967. Superfamily Sphecoidea. Pp. 386–421 *in* Hymenoptera of America north of Mexico. Synoptic catalogue (Agriculture Monograph No. 2). Second supplement. K. V. Krombein and B. D. Burks, eds. United States Department of Agriculture, Washington, D.C. 584 pp.

———. 1979. Superfamily Sphecoidea. Pp. 1573–1740 *in* Catalogue of Hymenoptera in America north of Mexico. Vol. 1. Symphyta and Apocrita (Parasitica): i–xvi, 1–1198 pp.; Vol. 2. Apocrita (Aculeata): i–xvi, 1199–2209 pp.; vol. 3. Indexes: i–xxx, 2211–2735 pp. K. V. Krombein, P. D. Hurd, Jr., D. R. Smith, and B. D. Burks, eds. Smithsonian Institution Press, Washington, D.C.

Krombein, K. V., and H. E. Evans. 1954. A list of wasps collected in Florida, March 29 to April 5, 1953, with biological annotations (Hymenoptera, Aculeata). Proc. Entomol. Soc. Washington 56:225–236.

———. 1955. An annotated list of wasps collected in Florida, March 20 to April 3, 1954 (Hymenoptera, Aculeata). Proc. Entomol. Soc. Washington 57:223–235.

Kurczewski, F. E. 1966*a*. *Tachysphex terminatus* preying on Tettigoniidae—an unusual record (Hymenoptera: Sphecidae, Larrinae). J. Kansas Entomol. Soc. 39:317–322.

———. 1966*b*. Comparative behavior of male digger wasps of the genus *Tachysphex* (Hymenoptera: Sphecidae, Larrinae). J. Kansas Entomol. Soc. 39:436–453.

———. 1967. *Hedychridium fletcheri* (Hymenoptera: Chrysididae, Elampinae), a probable parasite of *Tachysphex similis* (Hymenoptera: Sphecidae, Larrinae). J. Kansas Entomol. Soc. 40:278–284.

———. 1971. A new *Tachysphex* from Florida, with keys to the males and females of the Florida species (Hymenoptera, Sphecidae, Larrinae). Proc. Entomol. Soc. Washington 73:111–116.

———. 1979. Nesting behavior of *Tachysphex mundus* Fox (Hymenoptera, Sphecidae, Larrinae). Polskie Pismo Entomol. 49:641–647.

———. 1987. A review of nesting behavior in the *Tachysphex pompiliformis* group, with observations on five species (Hymenoptera: Sphecidae). J. Kansas Ent. Soc. 60:118–126.

Kurczewski, F. E., and N. B. Elliott. 1978. Nesting behavior and ecology of *Tachysphex pechumani* Krombein (Hymenoptera: Sphecidae). J. Kansas Entomol. Soc. 51:765–780.

Kurczewski, F. E., N. B. Elliot, and C. E. Vasey. 1970. A redescription of the female and description of the male of *Tachysphex pechumani* (Hymenoptera: Sphecidae, Larrinae). Ann. Entomol. Soc. America 63:1594–1597.

Kurczewski, F. E., and H. E. Evans. 1986. Correct names for species of *Tachysphex* observed by Evans (1970) at Jackson Hole, Wyoming, with new information on *T. alpestris* and *T. semirufus* (Hymenoptera: Sphecidae). Proc. Entomol. Soc. Washington 88:720–721.

Kurczewski, F. E., and B. J. Harris. 1968. The relative abundance of two digger wasps, *Oxybelus bipunctatus* and *Tachysphex terminatus*, and their associates, in a sand pit in central New York. J. New York Entomol. Soc. 76:81–83.

Kurczewski, F. E., and E. J. Kurczewski. 1963. An annotated list of digger wasps from Presque Isle State Park, Pennsylvania (Hymenoptera: Aculeata). Proc. Entomol. Soc. Washington 65:141–149.

Kurczewski, F. E. and N. F. R. Snyder. 1968. Evolution of cliff-nesting in digger wasps. Conservationist 23(2):28–31.

LaBerge, W. E. 1956. Catalogue of the types in the Snow Entomological Museum. Part I (Hymenoptera). Univ. Kansas Sci. Bull. 38:501–531.

Lavigne, R. J. and R. E. Pfadt. 1966. Parasites and predators of Wyoming rangeland grasshoppers. Univ. Wyoming Agric. Expt. Sta. Sci. Monogr. 3:1–31.

Linnaeus, C. 1758. Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Tomus I. Editio decima, reformata, Laurentii Salvii, Holmiae. Pp. [4] + [1–5] + 6 + 823 + [1].

Mickel, C. E. 1916. New species of Hymenoptera of the superfamily Sphecoidea. Trans. Amer. Entomol. Soc. 42:399–434.

———. 1918 (1917). A synopsis of the Sphecoidea of Nebraska (Hymenoptera). Nebraska Univ. Studies 17:342–456.

Miller, R. C. and F. E. Kurczewski. 1973. Ecology of digger wasps (Sphecidae). Pp. 204–217 *in* D. L. Dindal, ed., Proc. First Soil Microcommunities Conference, USAEC, Office of Inform. Serv. CONF-711076, Natl. Techn. Inform. Service, USDC, Springfield, Virginia.

Newton, R. C. 1956. Digger wasps, *Tachysphex* spp., as predators of a range grasshopper in Idaho. J. Econ. Entomol. 49:615–619.

Noonan, G. R. 1984. Type specimens in the insect collections of the Milwaukee Public Museum. Milwaukee Public Mus. Contrib. Biol. Geol. No. 58, titlepage, 1–14 pp.

Nurse, C. G. 1903. New species of Indian aculeate Hymenoptera. Ann. Mag. Nat. Hist. (7) 11:511–526.

Panzer, G. W. F. 1805. Faunae Insectorum Germaniae initia oder Deutschlands Insecten, Achter Jahrgang, LXXXIV–XCVI Heft. Nürnberg, pl. 1–22, index systematicus, pp. I–XV.

———. 1809. Faunae Insectorum Germaniae initia oder Deutschlands Insecten, Neunten Jahrgang, XCVII–CVIII Heft Nürnberg, pl. 1–22, index systematicus, pp. 1–13.

Parks, R. B., Jr. 1986. Aculeate Hymenoptera collected at Torrey Pines California State Reserve. Young Entomol. Soc. Quart. 3:33–35.

Patton, W. H. 1879. List of a collection of aculeate Hymenoptera made by Mr. S. W. Williston in northwestern Kansas. Bull. U.S. Geol. Geogr. Survey 5, No. 3. Pp. 349–370.

———. 1881 (1880). List of North American Larridae. Proc. Boston Soc. Nat. Hist. 20:385–397. Dating after Britton and Howard (1921).

Peckham, G. W. and E. G. Peckham. 1900. Additional observations on the instincts and habits of the solitary wasps. Bull. Wisconsin Nat. Hist. Soc., new series 1. Pp. 85–93.

———. 1905. Wasps, social and solitary. The University Press, Cambridge. i–xv + 311 pp.

Provancher, L. 1877–1882. Faune canadienne. Les Insectes.—Hyménoptères. Nat. Canad. 9(1877):346–349, 353–370; 10(1878):11–18, 47–58, 65–73, 97–108, 161–170, 193–209, 225–238, 257–273, 289–299, 349–352, 353–365, 11(1879):2–13, 33–43, 65–76, 119–125, 129–143 (No. 125), 109–122 (No. 126), 141–150 (No. 127), 173–185, 205–233, 248–266, 269–281; 12(1880), 4–22, 33–48, 65–81, 97–102, 130–147, 161–180; 12(1881):193–207, 225–241, 257–269, 289–304, 321–333, 352–362; 13(1882):4–15, 33–51, 65–81, 97–110, 129–144, 161–175, 193–209, 225–242, 257–269.

———. 1883. Petite faune entomologique du Canada et particulièrement de la province du Québec. Quatrième ordre. Les Hyménoptères. Quebéc, titlepage, 153–830 pp.

———. 1885–1889. Additions et corrections au volume II de la faune entomologique du Canada traitant des Hyménoptères. Québec, [1–2], 475 pp.

———. 1895. Les dernières descriptions de l'abbé Provancher. Nat. Canad. 22: 79–80, 95–97, 110–112, 129–131.

Pulawski, W. J. 1971. Les *Tachysphex* (Hym., Sphecidae) de la région paléarctique occidentale et centrale. Panstwowe Wydawnictwo Naukowe, Wroclaw. 464 pp.

———. 1974*a*. A revision of the Neotropical *Tachysphex* Kohl (Hym., Sphecidae). Polskie Pismo Entomol. 44:3–80.

———. 1974*b*. Notes sur la biologie de deux *Tachysphex* rares: *T. rugosus* Guss. et *T. plicosus* Costa (Hym., Sphecidae). Polskie Pismo Entomol. 44:715–718.

———. 1975 (1974). Synonymical Notes on Larrinae and Astatinae (Hymenoptera: Sphecidae). J. Washington Acad. Sci. 64:308–323.

———. 1977*a*. A synopsis of *Tachysphex* Kohl (Hym., Sphecidae) of Australia and Oceania. Polskie Pismo Entomol. 47:203–332.

———. 1977*b*. A revision of the Old World *Parapiagetia* Kohl (Hymenoptera, Sphecidae). Polskie Pismo Entomol. 47:601–669.

———. 1979. A revision of the world *Prosopigastra* Costa (Hymenoptera, Sphecidae). Polskie Pismo Entomol. 49:3–134.

———. 1982. New species of North American *Tachysphex* wasps (Hymenoptera, Sphecidae). Proc. California Acad. Sci. 43:27–42.

———. 1986. *Tachysphex peruanus*, a new species related to *Tachysphex galapagensis* Williams (Hymenoptera: Sphecidae). Pan-Pacific Entomol. 62:95–98.

Radoszkowski, O. B. 1877. Sphegidae. *In* Voyage au Turkestan d'A. P. Fedchenko, fasc. 14, tome 2, partie 5. Bull. Soc. Impér. Amis. Sci. Nat. 26:1–87, pl. I–VIII.

Rau, P. 1926. The ecology of a sheltered clay bank: a study in insect sociology. Trans. Acad. Sci. St. Louis 25:157–277.

———. 1946. Notes on the behavior of a few solitary wasps. Bull. Brooklyn Entomol. Soc. 41:10–11.

Rau, P. and N. Rau. 1918. Wasps studied afield. Princeton University Press, Princeton. i–xiv, 372 pp.

Richards, O. W. 1935. Notes on the nomenclature of the aculeate Hymenoptera, with special reference to British genera and species. Trans. Roy. Entomol. Soc. London 83:143–176.

Riley, C. V. 1878. Chapter XI. Invertebrate enemies. Pp. 284–334 *in* First annual report of the United States Entomological Commission for the year 1877 relating to the Rocky Mountain locust. Department of the Interior, Washington. Pp. i–xvi, 1–477, [1]–[294], pl. I–V, 2 maps.

———. 1880. Chapter XIII. Further facts about the natural enemies of the locusts. Pp. 260–271, pl. XIII *in* Second report of the United States Entomological Commission for the years 1878 and 1879, relating to the Rocky Mountain locust, and the western cricket. Department of the Interior, Washington. Pp. i–xiii, 6 maps, pp. 1–322, pl. I–XVI, pp. [1]–[80].

Robertson, C. 1928. Flowers and insects. Lists of visitors of four hundred and fifty-three flowers. Privately printed, Carlinville, Ilinois. 221 pp.

Rohwer, S. A. 1908. Some larrid wasps from Colorado. Entomol. News 19: 220–224.

———. 1910. Some new wasps from New Jersey. Proc. Entomol. Soc. Washington 12:49–52.

———. 1911. Descriptions of new species of wasps with notes on described species. Proc. U.S. Natl. Mus. 40:551–587.

———. 1914. Vespoid and sphecoid Hymenoptera collected in Guatemala by W. P. Cockerell. Proc. U.S. Natl. Mus. 47:513–523.

———. 1916. Sphecoidea. Pp. 645–697 *in* Guide to the insects of Connecticut. Part III. The Hymenoptera, or wasp-like insects of Connecticut. By H. L. Viereck, with the collaboration of A. D. MacGillivray, Ch. T. Brues, W. M. Wheeler, and S. A. Rohwer. W. E. Britton, ed. Bull. State Connecticut Geol. Nat. Hist. Survey 22. Pp. 1–824, pl. I–X.

———. 1917*a*. Descriptions of thirty-one new species of Hymenoptera. Proc. U.S. Natl. Mus. 53:151–176.

———. 1917*b*. A report on a collection of Hymenoptera (mostly from California) made by W. M. Giffard. Proc. U.S. Natl. Mus. 53:233–249.

———. 1923. New aculeate Hymenoptera from the United States. Proc. Entomol. Soc. Washington 25:96–103.

Rust, R. W., L. M. Hanks, and R. C. Bechtel. 1983. Aculeata Hymenoptera of Sand Mountain and Blow Sand Mountains, Nevada. Great Basin Naturalist 43:403–408.

Rust, R., A. Menke, and D. Miller. 1985. A biogeographic comparison of the bees, sphecid wasps, and mealybugs of the California Channel Islands (Hymenoptera, Homoptera). Pp. 29–59 *in* Entomology of the California Channel Islands, Proceedings of the First Symposium. A. S. Menke and D. R. Miller, eds. Santa Barbara Museum of Natural History, Santa Barbara, California. 178 pp.

Say, T. 1823. A description of some new species of hymenopterous insects. West. Quart. Rep. (Med., Surg., Nat. Sci.) 2:71–82.

Shuckard, W. E. 1837. Essay on the indigenous fossorial Hymenoptera, comprising a description of all the British species of burrowing sand wasps contained in the metropolitan collections; with their habits as far as they have been observed. Richter and Co., London. Pp. I–XII, 1 pl., 252 + [2] pp., pl. 1–4, [4] pp.

Sibuya, K. 1933. Biological notes on *Tachysphex japonicus* Iwata (Hymenoptera). Trans. Kansai Entomol. Soc. 4:51–64.

Smith, F. 1856. Catalogue of hymenopterous insects in the collection of the British Museum. Part IV. Sphegidae, Larridae and Crabronidae. By Order of the Trustees, London. Pp. 207–497.

——— 1873. Descriptions of new species of fossorial Hymenoptera in the collection of the British Museum. Ann. Mag. Nat. Hist. (4)12:49–59, 99–108.

Smith, H. S. 1906. Some new Larridae from Nebraska. Entomol. News 17:246–248.

——— 1908. The Sphegoidea of Nebraska. Nebraska Univ. Studies 8:323–410, 1 pl.

Smith, J. B. 1900 (1899). Insects of New Jersey. New Jersey State Board of Agriculture. 27th Annual Report, supplement. 755 pp., 2 maps.

——— 1910. A report of the insects of New Jersey. Ann. Rep. New Jersey State Mus. 1909:14–880.

Snow, F. H. 1881 (1879–1880). Preliminary list of the Hymenoptera of Kansas. Trans. Kansas Acad. Sci. 7:7–101.

——— 1906. List of species of Hymenoptera collected in Arizona by the University of Kansas entomological expeditions of 1902, 1903, 1904, 1905, and 1906. Trans. Kansas Acad. Sci. 20, part 2:1–13.

Spinola, M. 1806–1808. Insectorum Liguriae species novae aut rariores quas in agro Ligustico nuper detexit, descripsit et iconibus illustravit Maximilianus Spinola, adjecto catalogo specierum auctoribus jam enumeratarum, quae in eadem regione passim occurrunt. Genuae. 1 (1806), 159 pp., 2 pl.; 2 (1808), 262 pp., 5 pl.

Spofford, M. G. and F. E. Kurczewski. 1984. A new host for *Perilampus hyalinus* Say (Hymenoptera: Perilampidae). Proc. Entomol. Soc. Washington 86:663.

Spofford, M. G., F. E. Kurczewski, and D. J. Peckham. 1986. Cleptoparasitism of *Tachysphex terminatus* (Hymenoptera: Sphecidae) by three species of Miltogrammini (Diptera: Sarcophagidae). Ann. Entomol. Soc. America 79:350–358.

Steiner, A. 1962. Etude du comportement predateur d'un Hymenoptère Sphègien "*Liris nigra*" V. d. L. (="*Notogonia pompiliformis*" Pz.). Ann. Sci. Nat., Zool. (12)4:1–126, pl. I–IX.

——— 1973. Solitary wasps from subarctic North America—II. Sphecidae from the Yukon and Northwest Territories, Canada: distribution and ecology. Quaest. Entomol. 9:13–34.

——— 1981. Digger wasp predatory behavior (Hymenoptera, Sphecidae). IV. Comparative study of some distantly related Orthoptera-hunting wasps (Sphecinae vs. Larrinae), with emphasis on *Prionyx parkeri* (Sphecini). Z. Tierpsychol. 57:305–339.

——— 1982 (1981). Anti-predator strategies. I. Grasshoppers (Orthoptera, Acrididae) attacked by *Prionyx parkeri* and some *Tachysphex* wasps (Hymenoptera, Sphecinae and Larrinae): a descriptive study. Psyche 88:1–24.

Stevens, O. A. 1917. Preliminary list of North Dakota wasps exclusive Eumenidae (Hym.). Entomol. News 28:419–423.

Strand, E. 1910. Beitrage zur Kenntnis der Hymenopterenfauna von Paraguay auf Grund der Sammlungen und Beobachtungen von Prof. A. D. Anisits. I–VI. Unter Mitwirkung mehrerer Specialisten. Zool. Jahrb., Abt. Syst. 29:125–242.

Strandtmann, R. W. 1953. Notes on the nesting habits of some digger wasps. J. Kansas Entomol. Soc. 26:45–52.

Strickland, E. H. 1947. An annotated list of the wasps of Alberta. Canad. Entomol. 79:121–130.

Taschenberg, E. L. 1870. Die Larridae und Bembecidae des zoologischen Museums der hiesigen Universitat. Z. Ges. Naturwiss. 36:1–27.

Vesey-FitzGerald, D. F. 1956. Notes on Sphecidae (Hym.) and their prey from Trinidad and British Guyana. Entomol. Monthly Mag. 92:286–287.

Viereck, H. L. 1902–1903. Hymenoptera of Beulah, New Mexico. Trans. Amer. Entomol. Soc. 29:43–66 (1902), 67–100 (1903).

——— 1904. A handsome species of *Tachysphex* from Arizona (Hymenoptera). Entomol. News 15:87–88.

——— 1906. Notes and descriptions of Hymenoptera from the western United States in the collection of the University of Kansas. Trans. Amer. Entomol. Soc. 32:173–247.

Washburn, F. L. 1918. The Hymenoptera of Minnesota. State Entomologist Minnesota 17th Report 145–237.

Williams, F. X. 1914 (1913). The Larridae of Kansas. Kansas Univ. Sci. Bull. 8:121–213, pl. I–XXX.

——— 1931. Handbook of the insects and other invertebrates of Hawaiian sugar cane fields. Honolulu, Hawaii. 400 pp.

——— 1932 (1931). [Note on *Tachysphex fusus*.] Proc. Hawaii. Entomol. Soc. 8:17.

——— 1940 (1939). [Capturing a pair of *Tachysphex fusus*.] Proc. Hawaii. Entomol. Soc. 10:367.

——— 1941. An apparently undescribed *Tachysphex* (Hymenoptera, Larridae) from Trinidad, B. W. I. Proc. Entomol. Soc. London, Ser. B 10:197–199.

———. 1958. Four new sphecid wasps from western North America (Hymenoptera: Sphecidae, Larrinae). Pan-Pacific Entomol. 34:207–213.

Wray, D. L. 1950. Insects of North Carolina. Second supplement. North Carolina Department of Agriculture, Raleigh, North Carolina. 59 pp.

———. 1967. Insects of North Carolina. Third supplement. North Carolina Department of Agriculture, Raleigh, North Carolina. 181 pp.

Yoshimoto, C. 1960. Revision of Hawaiian Crabroninae with synopsis of Hawaiian Sphecidae (Hym.). Pacific Insects 2:301–337.

INDEX OF SPECIES NAMES

acanthophorus Pulawski 187
acutus (Patton) 34
aequalis W. Fox 172
aethiops (Cresson) 26
alayoi Pulawski 198
alpestris Rohwer 151
amplus W. Fox 115
angelicus sp. n. 33
angularis Mickel 21
antennatus W. Fox 72
antillarum Pulawski 149
apicalis W. Fox 164
apricus Pulawski 94
argyrotrichus Rohwer 20
arizonac Pulawski 129
armatus Pulawski 191
ashmeadii W. Fox 141
asperatus W. Fox 109
austriacus Kohl 20
belfragei (Cresson) 180
blatticidus Williams 193
boharti Krombein 75
bohartorum Pulawski 51
bruesi Rohwer 34
clarconis Viereck 147
cockerellae Rohwer 204
cocopa sp. n. 191
compactus W. Fox 25
consimilis W. Fox 20
consimiloides Williams 56
coquilletti Rohwer 200
crassiformis Viereck 75
crenulatus W. Fox 65
crenuloides Williams 176
cubanus Pulawski 77
dakotensis Rohwer 133
decorus W. Fox 20
dentatus Williams 200
dominicanus sp. n. 79
dimidiatus (Panzer) 20
eldoradensis Rohwer 46
erythraeus Mickel 21
exsectus W. Fox 169
fedorensis Rohwer 37
foxii Rohwer 164
fumipennis W. Fox 164
fusus W. Fox 164
gibbus Pulawski 75
giffardi Rohwer 40
gillettei Rohwer 115
glabrior Williams 112
granulosus Mickel 21
helianthi Rohwer 139
hopi sp. n. 47
huchiti sp. n. 126
hurdi R. Bohart 108
idiotrichus Pulawski 85
inconspicuus (Kirby) 193
inusitatus W. Fox 25
iridipennis (F. Smith) 196

irregularis Pulawski 55
johnsoni Rohwer 169
jokischianus (Panzer) 70
krombeini Kurczewski 70
krombeinellus Pulawski 181
laevifrons (F. Smith) 56
lamellatus Pulawski 130
leensis Rohwer 56
linsleyi R. Bohart 153
mancei Banks 122
maurus Rohwer 177
maya sp. n. 186
menkei Pulawski 184
minimus (W. Fox) 181
minor (Provancher) 156
mirandus Pulawski 102
miwok sp. n. 67
montanus (Cresson) 25
mundus W. Fox 169
musciventris Pulawski 88
neomexicanus Rohwer 115
nigrescens Rohwer 109
nigrior W. Fox 42
nigripennis (Spinola) 20
nigrocaudatus Williams 72
nitelopteroides Williams 139
oasicola sp. n. 113
occidentalis Pulawski 91
opata sp. n. 106
opwanus Rohwer 174
orestes sp. n. 31
paiute sp. n. 80
papago Pulawski 137
parvulus (Cresson) 20
pauxillus W. Fox 42
pechumani Krombein 50
pinal sp. n. 81
plenoculiformis Williams 75
plesius Rohwer 147
pompiliformis (Panzer) 20
posterus W. Fox 141
powelli R. Bohart 38
projectus Nurse 21
propinquus Viereck 141
psammobius (Kohl) 109
psilocerus Kohl 139
pullulus Strand 149
puncticeps H. Smith 40
punctifrons (W. Fox) 37
punctulatus H. Smith 40
quebecensis (Provancher) 20
quisqueyus sp. n. 156
robustior Williams 176
ruficaudis (Taschenberg) 149
rufipes (Provancher) 141
rufitarsis (Cameron) 172
rufoniger Bingham 20
schlingeri R. Bohart 133
scopaeus sp. n. 137
sculptilis W. Fox 109
sculptiloides Williams 72
semirufus (Cresson) 40
sepulcralis Williams 121
simulans Rohwer 161
similis Rohwer 161
solaris Pulawski 93
sonorensis (Cameron) 133
spatulifer Pulawski 63
sphecodoides Rohwer 110
spinosus W. Fox 141
spissatus W. Fox 141
sulcatus sp. n. 97
tahoe sp. n. 86
tarsatus (Say) 57
tenuipunctus W. Fox 20
terminatus (F. Smith) 156
texanus (Cresson) 121
tipai sp. n. 99
toltec sp. n. 83
triquetrus W. Fox 25
tsil sp. n. 131
utina sp. n. 179
verticalis Pulawski 104
washingtoni Rohwer 174
wheeleri Rohwer 75
williamsi R. Bohart 62
yolo Pulawski 117
yuma Pulawski 120